

NOVEMBER 1958

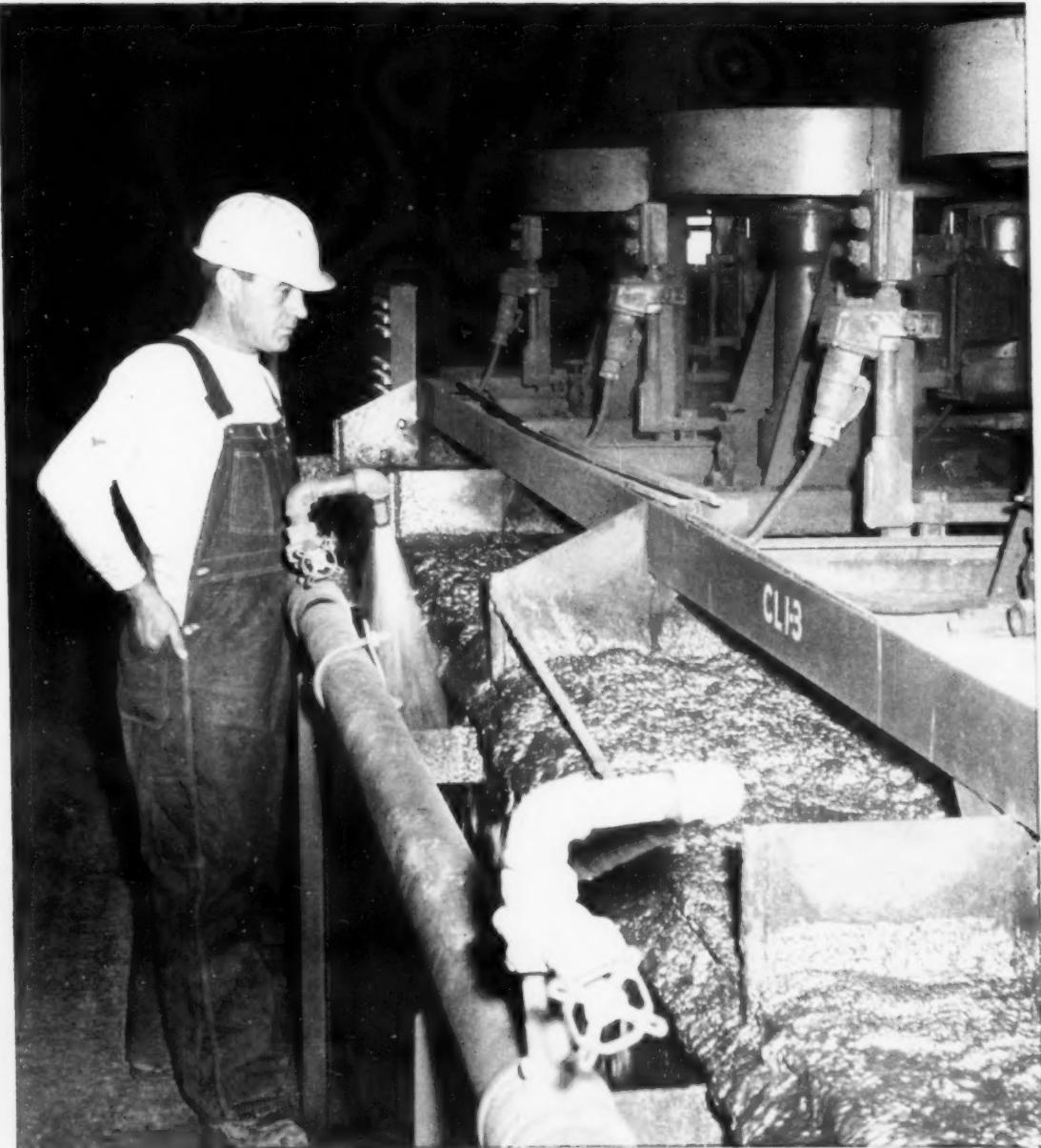
VOL. 20 NO. 12

MINING WORLD



Russia's Leading Iron Miners
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Why Krupp Renn Process Now
Competitive Costwise Page 44



How Pima Floats Copper Ore

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PRODUCER

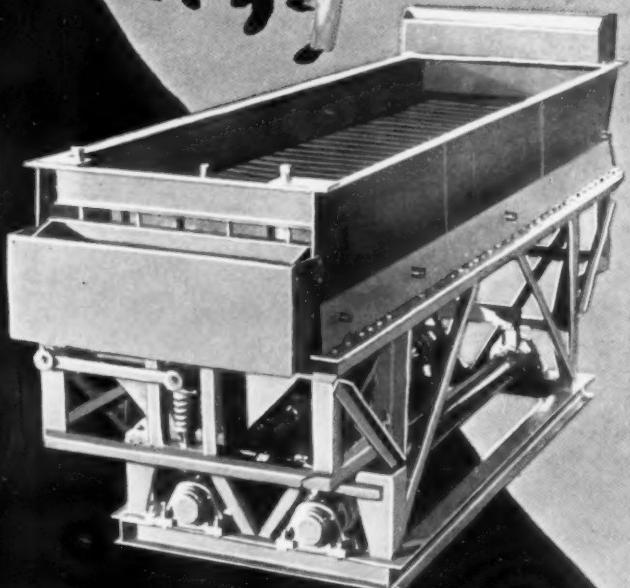
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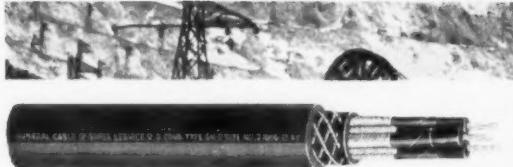


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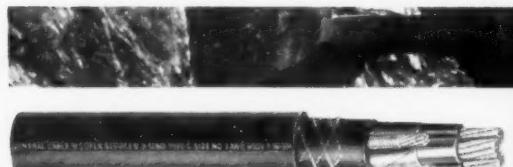
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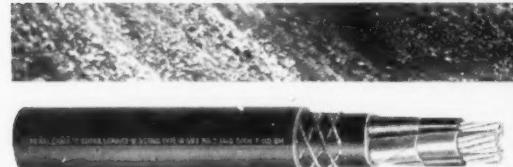
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L. W. Fielding



Mining World

Including the Export Edition WORLD MINING

Published monthly except in April when publication is semi-monthly

VOLUME 20

NOVEMBER 1958

No. 12

OPERATIONS—TECHNOLOGY

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Exploration

Geology and DMEA Exploration Find Ore at Abbott 33

California's 96-year-old Abbott mercury mine through interpretive geology and DMEA funds has more than doubled ore reserves. An unknown but parallel ore zone has been discovered along a shale-silicified serpentine breccia contact.

Russian Iron Miners Tour United States

Who Russians Are and Where They Went 39

Six leading Russian engineers have completed a tour of the United States as second part of Russian-United States Exchange. They visited Mesabi and Marquette Iron Ranges.

Metallurgy

How Pima Mills Copper Ore 40

Pima is first major nonferrous flotation mill to exclusively use cyclones for classification. Fagregren flotation machines make a rougher concentrate that is cleaned and recleaned in Denver machines.

Krupp Renn Process Now Used For Many Ores 44

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Conventions

New Equipment Shown at San Francisco Show 50

All that's new in mining and metallurgical equipment was shown by 180 manufacturers at the San Francisco Mining Show. Technical papers and governmental speeches filled the program.

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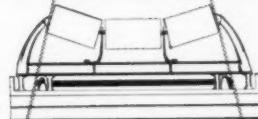
ON THE COVER

Pima Mining Company's new flotation mill south of Tucson, Arizona treats open pit ore. These Fagregren cells make rougher concentrate. The 1.87 percent copper ore is floated with lime, methyl isobutyl carbinol, Z-6 Xanthate, and Z-11 Xanthate to produce a 26.33 percent concentrate.

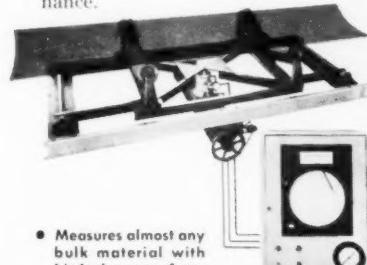


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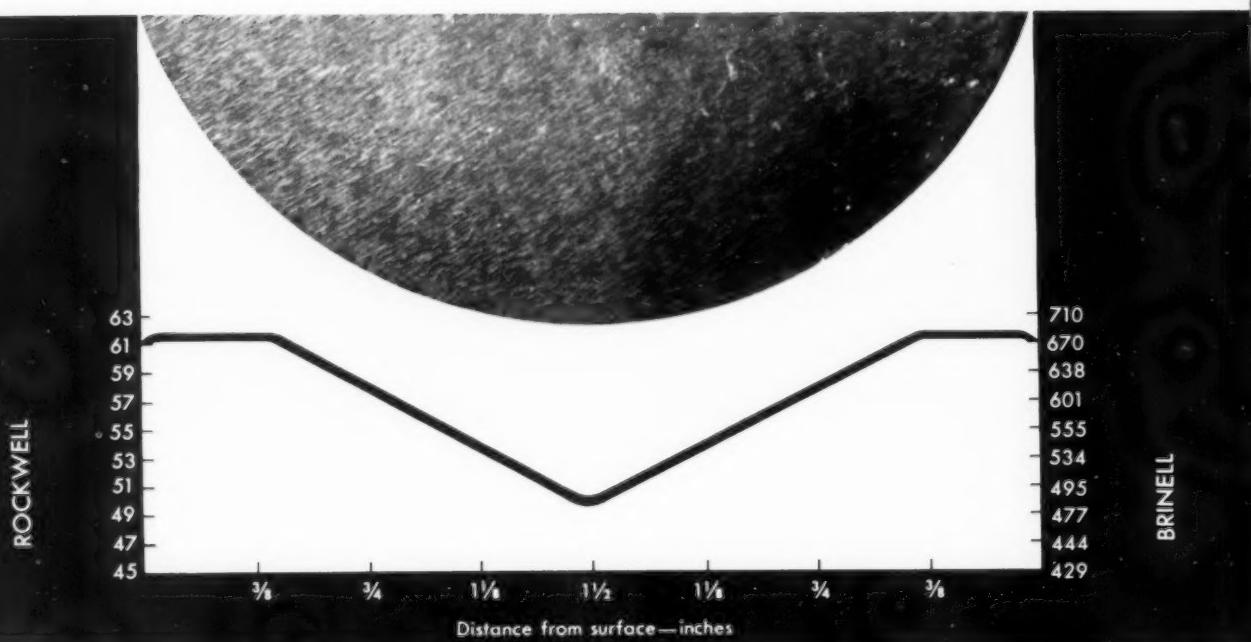
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Spectrographic analytical control of elements in steel making processes and controlled heat treatment assure the desired metallurgical grain structure which produce the type of hardness required for maximum wearing qualities.

Performance reports on Naco solid cast alloy steel grinding balls from mills now using them have been universally favorable—both in lasting qualities and impact absorption.

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500 Howard Street
San Francisco 5, Calif.
EXbrook 7-1881

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Published by American Trade Journals, Inc.
Wm. B. Freeman, President
L. K. Smith, Vice President
Miller Freeman, Jr., Sec-Treas.

WORLD MINING is published the 26th of each month as a regular department of MINING WORLD and is also circulated as a separate publication on a carefully controlled free basis to a selected list of management and supervisory personnel associated with active mining enterprises throughout the world.

Mining World Subscription Rates
U.S., North, South and
Central America \$4.00
Other Countries \$5.00
Single Copies \$.50
Directory Number \$1.00

CHANGE OF ADDRESS:
Send subscription orders and changes of address to MINING WORLD, 500 Howard St., San Francisco 5, Calif. Include both old and new addresses and zone numbers.

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Drifts and Crosscuts

What About Lead and Zinc Quotas?

The one point of unanimity about the lead and zinc import quotas, announced by President Eisenhower, is that "Quotas are not the final answer to a most difficult problem."

Axiomatically, there is only one final answer. Bring supply and demand in balance. How easy to propose, but how difficult to attain. Fortunately, the demand picture for all metals has definitely turned upward. Production is down—but dangerously precarious to the delicate demand-supply balance; it can be accelerated through the roof on an instant's notice.

The initial shock, disappointment, and hysteria about the quotas has been soothed by time. There is no question but that they will aid the domestic mining industry and there is no question but that domestic smelting companies can learn to live within the quotas.

Then, too, the quotas have two sides. Ores and concentrates versus metals. There is more agreement about the administration and equitability of the metal quotas. Ores and concentrates can be and will be worked out to the best interests of the most people.

Some of the loudest complaints have come from those very countries which have expanded production the greatest in the face of most obvious overproduction. Canada is one country where both lead and zinc output for first seven months of 1958 was higher than in 1957. Canada wasn't hurt either by the lead quota which is larger than actual exports in 1957. See table on page 9 for details. Bolivian protests were particularly bitter about the lead quotas. In contrast there were no public thanks or true friendship manifest when the United States, almost simultaneously, made another \$10,000,000 gift to support Bolivia's economy.

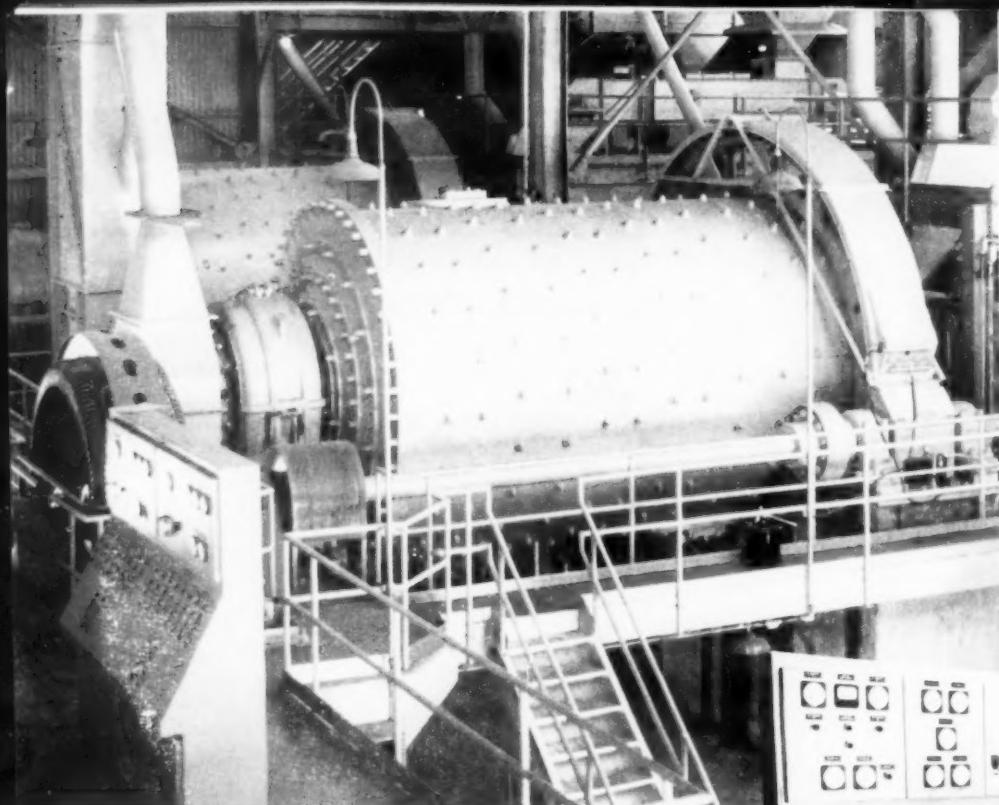
One Australian newspaper carried on its front page on the following seven words: "U. S. Metal Move Blow to State." But the record shows that Australia has stepped up exports to the United States from 80,034 tons of lead in 1954 to 135,591 tons in 1958. Zinc was up from 5,441 to 18,279 tons in same period.

In all fairness to Australia, the Broken Hill group of mining companies favors a cut in exports of both lead and zinc by all countries.

The United States' contribution to solving overproduction has been most painful—a drastic cut in mine production—as is well known here. However, this is both unknown and overlooked abroad. The fact is that daily average lead production through July this year was 682 tons; down from 927 in 1957. Zinc through June was down to 1,197 daily tons from 1,457 in 1957.

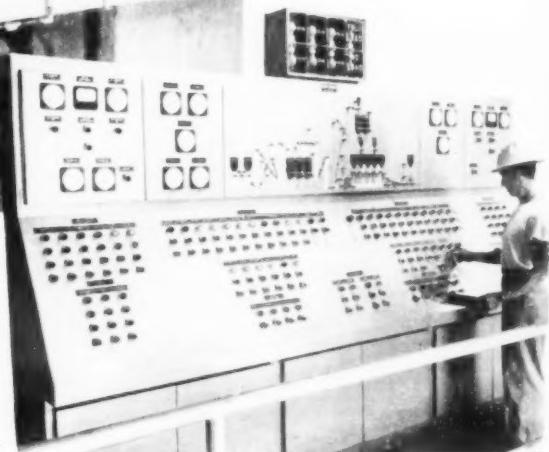
While Quotas aren't the final answer, they have precedent. Semivoluntary oil import quotas are working despite refiners' complaints; largely because of a tough Navy Captain as administrator. Proof that quotas do work is the sugar quota system. The world-wide sugar industry has learned how to operate under it.

The lead and zinc industry has the opportunity to do the same.



Left: Two of five 11' x 17' Nordberg Grinding Mills installed for dry process service at a new cement plant.

Below: Close-up view showing modern, functional Nordberg grinding mill control console, with interlocking relays for sequence starting of all equipment. Note flow diagram with indicator lights at center of top panel.



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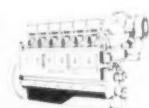
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MINING WORLD NEWSLETTER

San Francisco . . . Massena . . . Jeffrey City
November 1958

Lead, zinc, and copper prices are spiraling upward at last.

Increased demand and setting of import quotas are having a favorable effect on the lead and zinc markets. Increased business activity and less available copper supplies are influencing the world copper market.

Lead has made its fifth price advance within a month, rising from the recession low of 10.75¢ (N.Y.) to 13.00¢ at this writing.

Zinc, at 11.00¢ (East St. Louis) — up a cent over the past month, has been sparked by increased buying of Prime Western zinc for steel mills, and Die Casting Alloy for 1959 automobiles.

Copper's price in the U.S. has risen to 28.5¢ per pound; in London, it has hovered between 29.50 and 30.00¢, while Union Miniere de Haut Katanga has advanced its price to 28.80¢ per pound at Antwerp and New York. A rush to replenish hand-to-mouth inventories, coupled with shrinking of supply through production cuts and recent strikes, has tipped the balance in favor of the producer.

Sharply increased activity in metals futures shows consumers feel era of low metal prices is at an end, and they buy futures as hedge against increasing prices.

Transactions in lead futures have risen to 1,976 contracts during the first nine months of 1958 from 215 in the same period of 1957.

Zinc futures trading increased to 4,202 contracts in the past nine months from 1,590 during the same period of 1957.

Copper futures reached a new peak with 3,402 contracts (50,000 pounds each), compared with 317 a year ago.

News about other metals:

Foreign silver market is strong. Demand is good and world silver price is up.

Aluminum production is being resumed by Reynolds Metals Company at its Troutdale, Oregon plant; Aluminum Company of America has reactivated the Point Comfort, Texas plant, and has started up a new potline at the Massena, New York plant.

A study of tungsten and cobalt is underway by the Office of Civil and Defense Mobilization to determine if imports of these metals are harming national security.

Uranium mill expansion is moving into final stages.

Wyoming gets the big increase! The AEC and Gas Hills operators have worked out details for two new mills and expansion of three others.

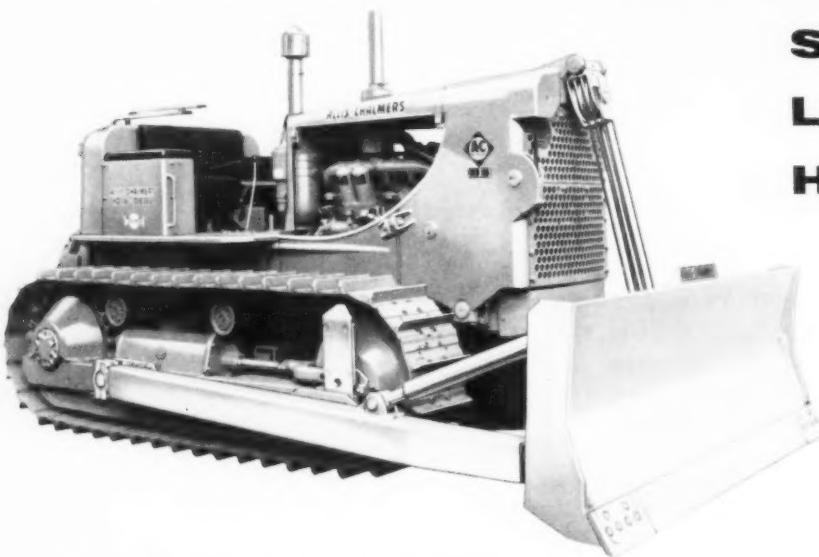
A daily rate of 3,585 tons is the district's new milling capacity.

Here's how the tonnage will be allocated: Federal Uranium, authorized at 522 tons daily capacity, will treat ore from Raderock and Gas Hill Uranium; Union Carbide Nuclear, authorized at 492 tons, will treat custom ore from the East Gas Hills area; Western Nuclear will increase its capacity from 440 to 845 tons, receiving ore from the Phelps Dodge operation—Green Mountain Uranium Company; Fremont Minerals increases capacity from 550 to 724 tons, receiving Vitro Minerals' ore; and Lucky Mc increases from 825 to 1,002, receiving Lisbon Uranium's ore. Small custom shippers will also supply all of these mills.

Watch for a major underground mine to develop in this area. Phelps Dodge, according to reports, will mine its Green Mountain deposit by underground methods instead of open pit, although some stripping may remove part of the orebody.

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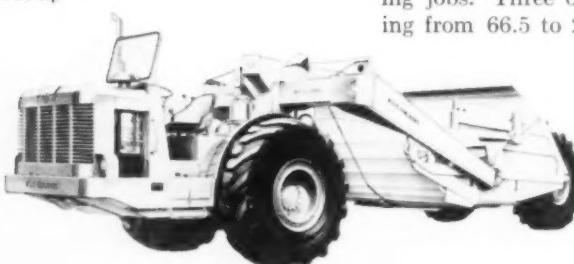


150 net engine hp
(torque converter drive)
148 net engine hp
(standard transmission)
41,000 lb (approx.)
with cable-controlled
bulldozer

HD-16 Crawler Tractor

Here is the big tractor value for many strip mining jobs. With choice of hydraulic torque converter drive or dual range, constant mesh transmission, the HD-16 quickly clears brush, stumps and boulders to open new areas. When stripping operations begin, it removes overburden with matched Allis-Chalmers bulldozer, pushes or pulls scrapers, and stockpiles overburden for future reclamation. During mining operations, it moves material within reach of excavators, helps build access roads, moves drill rigs and other equipment . . . handles countless pushing and pulling jobs. Three other crawler tractor models are available, ranging from 66.5 to 225 net engine hp.

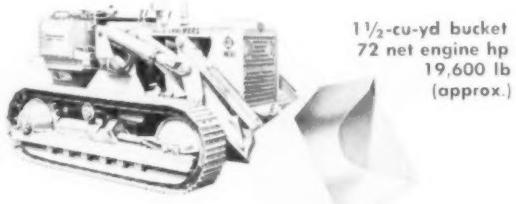
15 yd struck
20 yd heaped
280 hp



TS-360 Motor Scraper

is designed for big-capacity stripping jobs. Curved bowl bottom and offset cutting edge help get full loads fast. High apron lift and positive, forced ejection combine to dump all material cleanly and spread it evenly.

An interchangeable bottom-dump body can be used for fast off-highway hauling. Two other Allis-Chalmers motor scrapers are also available with 9½-yd and 14-yd heaped capacities.



HD-6G Tractor Shovel

Has the mobility to move quickly from one job to another anywhere in the mine . . . has the power and capacity to handle a variety of digging and loading operations. This combination has made the HD-6G a popular handyman in many strip mines. Three larger tractor shovels are also available with standard buckets up to 4 cu yd and coal buckets up to 7 cu yd.

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Capitol Concentrates

President Sets Import Quotas for Lead and Zinc with Allocations by Countries

Lead and zinc producers did not react with enthusiasm to the President's announcement that quotas would be imposed limiting lead and zinc imports to 80 percent of the average annual commercial imports during the five years 1953-1957. Instead, they took more of a "wait and see" attitude, although expressing keen disappointment that the President had not used his new powers under the Trade Agreements Extension Act of 1958 to increase tariffs.

In the words of Charles E. Schwab, chairman, Emergency Lead-Zinc Committee, "Very little will be gained at this point in speculating whether in the future the quota plan will do the job or not. Had the formula amounted to the quotas set by the three Tariff Commissioners, comments would have been vastly different. There has been a major policy 'break through,' however

Import Quotas for Lead and Zinc in Short Tons by Countries of Origin by Quarters and Annual, and Actual Imports First Six Months of 1958 and 12 Months 1957

Country	LEAD						1957 Imports
	Quarterly Quota Ores, Mattes	Annual Quota Ores Etc.	Quarterly Quota, Bullion, Pigs, Bars	Annual Quota Bullion Etc.	Imports First Six Months 1958	1957 Imports	
Peru	8,080	32,320	6,440	25,760	142,433 ¹	55,450 ²	
Union					127,525 ³	34,990 ⁴	
South Africa	7,440	29,760			30,500	43,916	
Canada	6,720	26,880	7,060	31,840	112,790 ⁵	25,193 ⁶	
Australia	5,040	20,160	11,840	47,360	122,236 ⁷	28,607 ⁸	
Bolivia	2,520	10,580			18,141 ⁹	36,995 ¹⁰	
Mexico					152,402 ¹¹	95,517 ¹²	
Yugoslavia					7,443	18,316	
All others	3,280	13,120	3,040	12,160	24,083	40,262	
					42,850	45,844	
ZINC							
Country	Quarterly Quota Ores	Annual Quota Ores	Quarterly Quota, Slabs, Dust, Bars	Annual Quota Slabs Etc.	Imports First Six Months 1958	1957 Imports	
Mexico	35,240	140,960	3,160	12,640	102,000	119,231 ¹³	
Canada	33,240	132,960	18,920	75,680	115,600	115,220 ¹⁴	
Peru	17,560	70,240	1,880	7,520	63,000	110,964 ¹⁵	
Belgium and Luxembourg	—	—	3,760	15,040	17,400	34,191 ¹⁶	
Belgian Congo	—	—	2,720	10,880	12,300	33,007 ¹⁷	
Italy			1,800	7,200	2,900	10,001 ¹⁸	
All others	8,920	35,680	3,040	12,160	32,500	96,599	

1. Ores, mattes etc. 2. Bullion, pigs, bars etc. 3. Ores (Except pyrite containing not over 3.0 percent zinc). 4. Slabs, blocks, pigs etc.

inadequate we may now feel the results may be. The responsibility for the program clearly rests with the Administration. It is not the program that we have basically suggested; one which we knew would correct the problem. That would be the exercise of the President's new powers

under the Trade Agreements Extension Act of 1958 whereby today adequate tariffs could be imposed."

Quota restrictions, on a country of production basis, were established quarterly, beginning October 1, 1958. They will permit the importation of 354,720 short tons of lead a year, against a five-year average of 481,638 tons, and 520,960 short tons of zinc, against a five-year average of 651,200 tons. Domestic producers generally feel that the 20 percent cut is inadequate, particularly when the rate of United States consumption and excess stocks are taken into consideration.

• No Aid Offered By U. N. Conference

As might be foreseen, the United Nations metals conference in London produced no plan to put the international copper situation in order. The tip-off probably was the selection of a Briton as chairman of the conference and an Australian as vice-chairman. Evidently, the United States took a back seat.

The conference decided that the copper situation is not so rough that it requires anything to be done and, anyway, they can easily get together again if it seems important to do so. With British and Australian leadership, no doubt the other copper producing countries out-voted us. It was commented that United States copper mines are "marginal" compared with foreign mines and the implication is, "Why should we go out of our way to help them? We are getting along all right." Well—it was a nice juncture anyhow!

Arranging checks on world production of copper, lead and zinc would be no easy task, but to arrange for allocations of supply between countries would be even more difficult. Even during the war the International Materials Board had a continual series of headaches at a time when metals were short. To try and choke back production and to limit imports and exports on a voluntary basis poses a most difficult problem. At any rate, the fact that the conference was called at all indicates an international realization of the seriousness of the problem. Uncle Sam, however, seems to be the big, bad wolf!

• Field Hearings Planned On Wilderness Bill

Early November dates have been announced by the Senate Interior Committee for field hearings on the bill (S. 4028) to establish a National Wilderness Preservation System on public lands.

This bill, the latest in the series of bills designed to limit the use of large areas of national forests and other public lands to the esthetic enjoyment of a relatively few wilderness enthusiasts, was sponsored by Senators Humphrey of Minnesota, Neuberger of Oregon, and Douglas of Illinois. It would bar prospecting and mining within all areas included in the Wilderness System unless the President authorized such activity in specific areas, under rules he deemed desirable. The proposition has brought forth strenuous opposition from the mining industry and other users of the national forests.

The schedule of field hearings is as follows: Bend, Oregon, November 7; San Francisco, California, November 10; Salt Lake City, Utah, November 12; and Albuquerque, New Mexico, November 14.



More capacity, less weight, longer service life, and lower costs—these are the advantages you get by using USS "T-1" Steel in mining equipment.

Dippers that ram through rock

built stronger, tougher and lighter with  "T-1" Steel

Did you ever cling to the "crow's nest" of one of the new giant shovels and feel it ram into a wall of rock and shale? The big machine shudders, then braces its feet and digs in with all its tremendous mechanical muscle. The dipper becomes a real battering ram—and you wonder how any steel can stand such punishment, day after day.

United States Steel engineers and metallurgists asked the same question, and developed a special steel, USS "T-1" brand. This steel can take terrific shock and impact abrasion. It's extremely tough—even at 50° below zero. And it is now available with more than three times the yield strength of structural carbon steel—100,000 psi minimum.

This great strength permitted a weight saving of 40 tons in one large shovel where "T-1" Steel

was used in the dipper, dipper stick, bail and crowd rack. In spite of the high strength, shovel manufacturers had no difficulty welding, forming and machining this quenched and tempered alloy steel.

USS "T-1" Steel can help you. Consider it where you need a steel with great strength, extraordinary toughness, or resistance to impact abrasion combined with ease of fabrication. Write for our book *USS "T-1" Steel*. United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

Immediate Delivery. USS "T-1" Steel products are now immediately available in minimum mill quantities. Reason: our new continuous heat-treating line is now in full operation. It assures better delivery as well as top quality.

USS and "T-1" are registered trademarks.

United States Steel Corporation—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Supply—Steel Service Centers
United States Steel Export Company



United States Steel

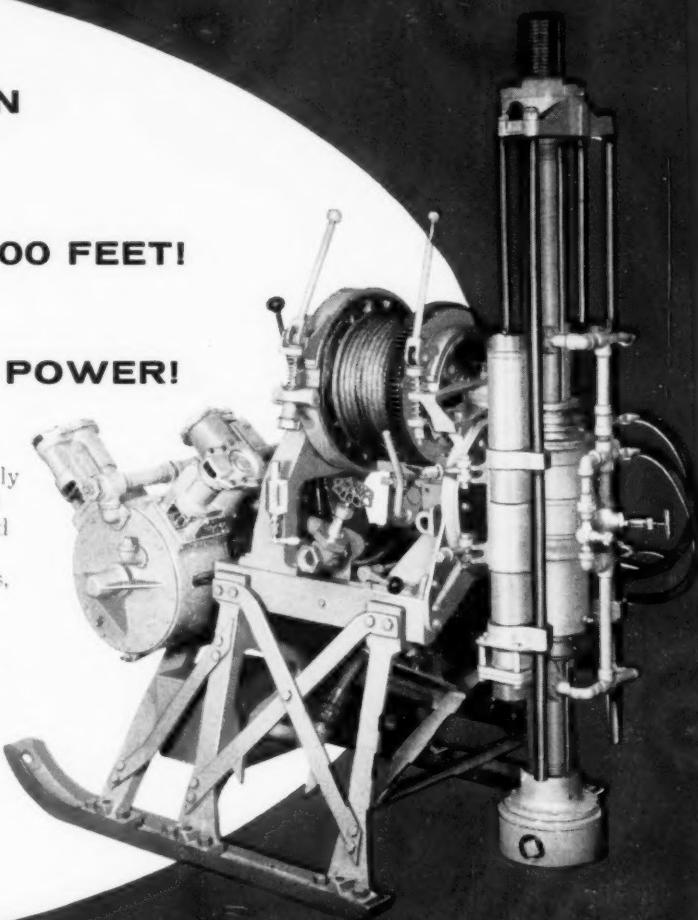
take it
**UNDERGROUND IN
A 5-FOOT CAGE!**

drill
HOLES UP TO 3500 FEET!

move it
UNDER ITS OWN POWER!

Here's an air-powered drill specifically developed for DEEP underground diamond drilling. It has a four speed transmission and optional hydraulic or gear feed swivelheads, which will pass up to 3 $\frac{1}{2}$ " O.D. tubing, for large hole drilling.

Model BBS-2UG, less swivelhead, can be moved from level to level inside a 5 foot cage and can be moved under its own power in drifts or crosscuts, where mine tracks have been removed. It can be easily dismantled into sub-units, when necessary.



BBS-2UG



BOYLES BROS.
DRILLING COMPANY LTD.
VANCOUVER, CANADA

SPECIFICATIONS

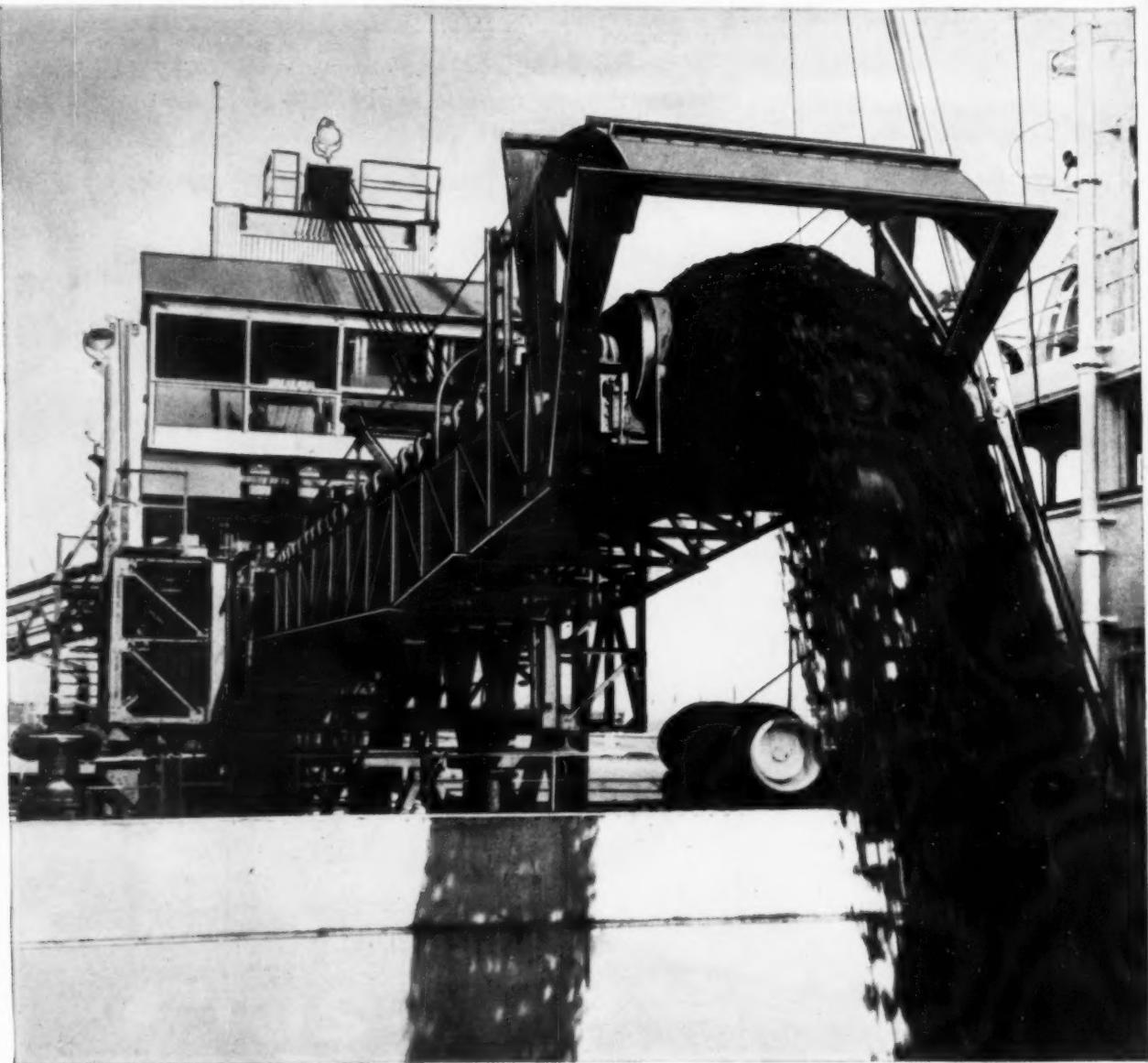
Rated depth capacity - - AX 3500 feet
BX 2400 feet
NX 1950 feet

Net weight range - - - 1865 to 2495 lbs.

Write for Bulletin No. BB-44

57-70

BOYLES BROS. DRILLING CO. LTD., NEWCASTLE-ON-TYNE, ENGLAND • BOYLES BROS. (PTY) LTD., JOHANNESBURG, SOUTH AFRICA
BOYLES BROS. (PTY) LTD., KITWE, NORTHERN RHODESIA • ATLANTIC, GULF AND PACIFIC COMPANY OF MANILA, PHILIPPINES
DR. ALBERTO BIANCHI, MILANO, ITALY • CIA. "DIAMANTINA B. H." S. A., LIMA, PERU • DIMITRY SCALISTIRI, ATHENS, GREECE
FORMAC S. A., RIO DE JANEIRO, BRAZIL • HAERRE AND COMPANY, A/S, OSLO, NORWAY • ITEC, S. R. L., BUENOS AIRES, ARGENTINA
JOHANSSON & CIA. S. A., LA PAZ, BOLIVIA • SHIROKO TRADING COMPANY S. A., TOKYO, JAPAN • TRILLIANCE ENGINEERING CO., BOMBAY
INDIA • WIESE AND CA. LDA., LISBON, PORTUGAL



Part of a huge ore handling system at Seven Islands, Quebec, this is one of two 60" wide boom type belt conveyors which feed ore directly into a ship's hold. The twin boom ship loading system delivers 8000 T.P.H.

STEPHENS

THE BIG NAME IN BULK MATERIALS HANDLING



BELT CONVEYORS



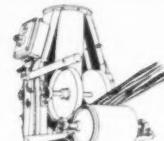
CARRIERS



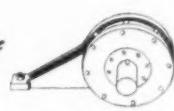
MANGANESE
STEEL PAN FEEDERS



TUNNEL GATE



SWIVELLOADERS



ENCLOSED TYPE
HOLDBACKS

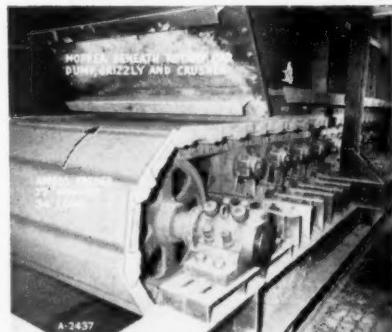
FROM MINE TO MILL--THE S-A WAY

Swift, economical handling of vast ore tonnages made possible with conveying equipment conceived and engineered by Stephens-Adamson

The fantastic ore tonnages being carried today from mine to mill, have been made possible largely thru the employment of ingenious conveying machinery. STEPHENS-ADAMSON is a chief contributor to the science of bulk materials conveying by developing concepts and equipment in general use today by metal, coal and mineral miners throughout the world.

Heading a long list of outstanding S-A engineering achievements is the first ball bearing belt conveyor carrier which made the long distance belt conveyor feasible. It opened the way for the most practical, lowest cost method of bulk material transportation ever conceived by man. The magnitude of this accomplishment is scarcely measureable in our era of high-speed production and insatiable demand for raw materials. As an appropriate sequel, S-A followed up by designing and building the longest underground belt conveyor system in the world!

STEPHENS-ADAMSON has earned its big name the hard way — with engineering skill — by building quality equipment for 57 years. That's why, if you have a conveying problem, your interests will be served best by the men who know conveying best — the men from S-A.



Car dump discharges ore to a grizzly which permits minus 5" ore to fall directly to this 72" wide AMSCO manganese steel pan feeder. STEPHENS-ADAMSON builds feeders in any practical width or length to handle any size ore lumps.



This S-A belt conveyor system operates at the 1200 foot level of a Menominee Range mine. It is the second of two similar conveyor systems installed since 1946. The 36" wide belt rides on S-A carriers. Capacity of the system is 250 T.P.H. with a belt speed of 200 F.P.M.



This 1200 foot long inclined S-A belt conveyor delivers primary crushed ore to storage at a secondary crushing plant. Belt is 48" wide and total lift is 190 feet. Headshaft is provided with an S-A hold-back to prevent belt reversal under load in case of power failure.



One of the finest ore unloading docks in the nation is at Curtis Bay, Md. The conveying system was engineered and built by S-A. Ocean-going vessels are unloaded and their cargoes delivered to waiting rail cars. Belt conveyor carries material almost 900 feet to car loading station.

-ADAMSON

EQUIPMENT

S-A district or main plant offices can supply complete information on any conveyor product or any phase of ore handling. Just write or call.



MFG. CO.
MAIN OFFICE AND PLANT
13 RIDGEWAY AVENUE
AURORA • ILLINOIS

PLANTS LOCATED IN: LOS ANGELES, CALIFORNIA
CLARKSDALE, MISSISSIPPI • BELLEVILLE, ONTARIO



Digging iron ore on the Mesabi Range near Aurora, Minnesota.

MARION 151-M—Power For Unmatched Digging in Mines and Quarries

A Marion 151-M in action is a familiar sight in many parts of the iron range, in copper mines, coal pits and quarries throughout the world. This 7-yard machine is ruggedly built throughout with ample power for continuous, high-speed production. It is readily convertible to dragline service with boom lengths from 80' to 120' and buckets from 4 to 8 yards.



Consult Marion Mining Specialists
for lower costs on your property.



A 40-ton Marion 43-M truck crane loads 69,000 pounds at 13 feet. Such standard features as a torque converter, Marionair Control, power raising and lowering of the gantry and ballast give the operator big advantages. The strong, highly mobile carrier provides maximum maneuverability during travel and on the job.

MARION POWER SHOVEL COMPANY—MARION, OHIO, U. S. A.
A Division of Universal Marion Corporation

INCREASE CORE RECOVERY

IN "HARD TO CORE"
FORMATIONS

Christensen adapts equipment to deliver highest percentage core recovery

Until recently the mining industry has had to put up with very poor core recovery in soft, sticky or unconsolidated formations, making accurate analysis of ore reserves extremely difficult. To increase core recovery Christensen, working closely with the operator, adapted equipment to the job. This newly adapted soft formation equipment cores ahead of the circulating fluid, protecting the core from fluid erosion. Today the geologist is receiving complete soft formation cores which enable him to fully analyze the ground below the rig for productive ore bodies. This is the result of a Christensen field consultant working in the field with the operator to adapt equipment to the job. **Whether it is soft formation or hard abrasive fractured rock, Christensen know-how is always available to help you increase core recovery and operate at "less cost per foot," regardless of operating conditions.** Call or write the Christensen field consultant nearest you today.

Every dollar invested in exploration is spent for the sole purpose of evaluating ore reserves. To properly analyze the ground below the rig, the geologist must have "good" cores. Christensen's $4\frac{1}{2}'' \times 3''$, B-3018 barrel delivers best possible cores in soft formations. For more detailed information write Christensen Diamond Products. Specify No. SF-967.



Diamonds Mean, "Less cost per foot."

CHRISTENSEN DIAMOND PRODUCTS

1937 SOUTH SECOND WEST • SALT LAKE CITY, UTAH



SOMETHING NEW UNDER THE GROUND



Revolutionary I-R "DOWNHOLE" DRILL

*service-proved on millions of feet of hole,
now available in FOUR SIZES,
with constant, thru-the-bit hole cleaning!*

The I-R DOWNHOLE drill is a rugged, heavy-duty, sub-surface percussion drill that delivers full striking power *right at the bit*. Hundreds of units, in operation all over the world, have drilled millions of feet of hole with outstanding records of performance and economy.

Designed for use with Ingersoll-Rand Drillmaster and Quartermaster drilling rigs, the DOWNHOLE drill is also available to present users of other types of rotary drilling equipment. Conversion from roller cone bits to DOWNHOLE drilling is simply a matter of screwing the drill to the rod or adapter and adding an air-line lubricator.



Here are some of the features that put the DOWNHOLE drill in a class by itself.

PATENTED HOLE CLEANING. All operating air is exhausted through the bit and additional high-pressure air blows continuously through the bit for maximum hole cleaning, even while drill is not running.

RENEWABLE WEAR SLEEVE. The entire unit is encased in a renewable wear sleeve that can be replaced at low cost when the outside diameter is worn down. (Patent Pending)

THREADLESS CARSET BIT DESIGN. The service-proved result of years of experimentation and field operation, it has no threads to strip or work loose and no energy loss through a separate connection.

SEALED UNIT. There are no ports in the outside of the drill which could admit abrasive material into the working parts.

CHECK VALVE. An optional check valve can be mounted behind the drill to permit operation under great heads of water—keeps mud and cuttings out of the machine even when the drill is stopped.

SPECIFICATIONS

DHD-275

DHD-325A

DHD-400

DHD-500

BIT SIZES	4 3/4" & 5"	6" & 6 1/2"	7" & 7 1/2"	9"
ROD SIZES (O.D.)	4"	4" & 5"	5 1/2"	7"
LENGTH (BIT EXTENDED)	52 3/4"	52 1/2"	63 1/4"	68 1/4"
OUTSIDE DIAMETER	4 1/4"	5 1/8"	6"	7 1/4"
WEIGHT (INCLUDING BIT)	158 lb.	236 lb.	362 lb.	586 1/2 lb.

For further details, send for a copy of Bulletin 4203.



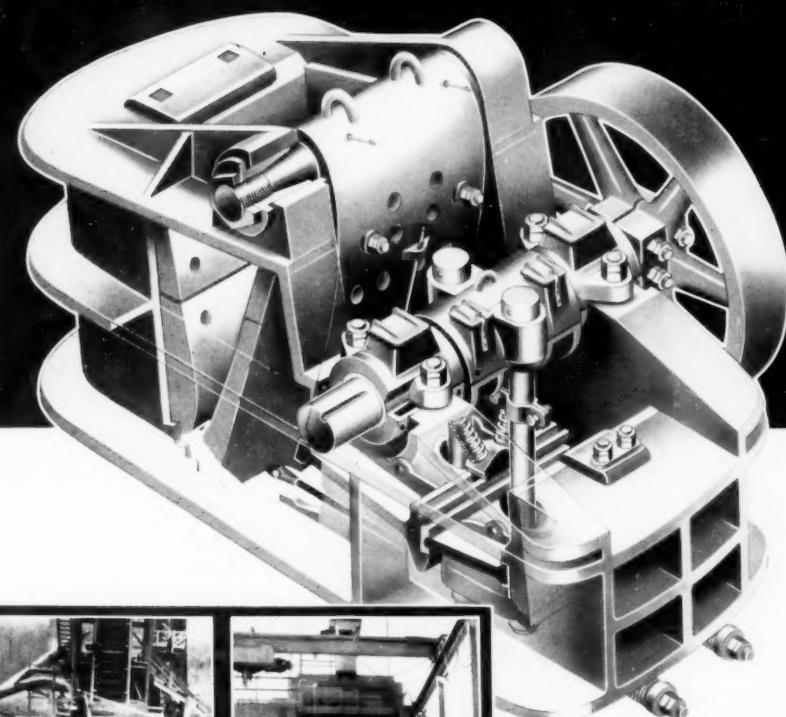
Ingersoll-Rand
11 Broadway, New York 4, N.Y.

A CONSTANT STANDARD OF QUALITY IN EVERYTHING YOU NEED FOR DRILLING ROCK

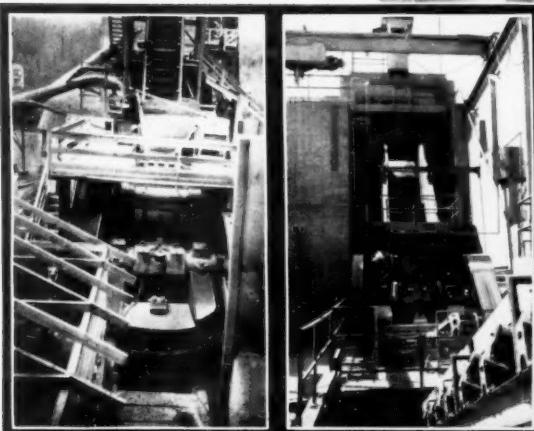


TRAYLOR-MADE

is engineering craftsmanship

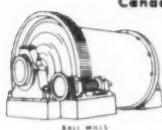


Type HB
Jaw Crusher

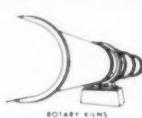


48" x 60" type HB Jaw Crusher in primary service, reducing quarry material to desired size.

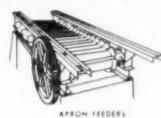
Cutaway view of the type HB Jaw Crusher shows the advance design characteristics of Traylor-Made Jaw Crushers—notice the sturdy bulldog pitman. One of the many important features of this crusher is the Traylor curved jaw plate. This design employs the principal of the famous curved fittings which have proved so successful and satisfactory in Traylor crushing machinery. Write for Bulletin #5105 for information.



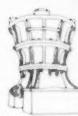
BALL MILLS



ROTARY KILNS



APRON FEEDERS



PRIMARY GYRATORY CRUSHERS



JAW CRUSHERS



SECONDARY GYRATORY CRUSHERS

High in the Peruvian Andes

RIO PALLANGA gets Maximum Profit with CYANAMID REAGENTS

Optimum cost-plus-tails varies for every ore and property in every mining district as every metallurgist knows.

But the most economic recovery at a particular mill can only be attained by careful evaluation of all milling costs, patient testing . . . and the right combination of Cyanamid Reagents. RIO PALLANGA proves that!

SINDICATO MINERO RIO PALLANGA treats 350 tpd of an unusual lead-zinc ore by straight flotation. By study of reagent combinations and overall mill economics, the mill staff working with a Cyanamid Field Engineer evolved this very low-cost reagent set-up:

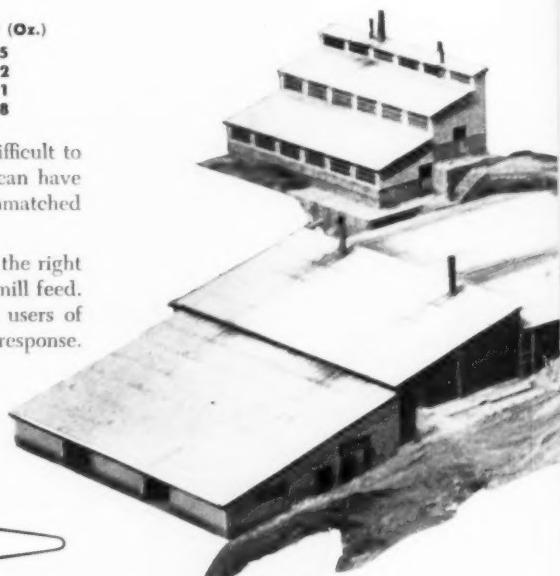
Lead Flotation	Lb./ton	Zinc Flotation	Lb./ton
AEROFROTH® 70 Frother	0.017	SODIUM AEROFLOAT® Promoter	0.074
AEROFLOAT® 25 Promoter	0.006	Copper Sulphate	0.517
AERO® Thiocarbamilide 130	0.188	Screened Lime	1.106
Sodium Cyanide	0.003		
Zinc Sulphate	0.102		
Sodium Silicate	0.068		

At Rio Pallanga lead concentrate grade is deliberately lowered by floating some pyrite in order to get the optimum local smelter rate. To avoid excessive grinding costs (which would be required to liberate finely disseminated sphalerite in the dolomite gangue), somewhat higher-than-average zinc tailings are tolerated. Sodium silicate is used to help depress quartz. Typical mill assays are:

	% Zinc	% Lead	Silver (Oz.)
Heads	5.1	4.1	7.5
Lead Concentrate	6.7	52.6	91.2
Zinc Concentrate	59.1	0.2	3.1
Tails	0.9	0.1	0.8

Whether your tonnage is large or small, whether or not your ore is difficult to beneficiate or your operating condition poses special problems, you can have the benefits of Cyanamid world-wide ore dressing experience and unmatched research background.

A Cyanamid Field Engineer stands ready to work with you to evolve the right combination of Cyanamid Reagents for lowest cost-plus-tails on your mill feed. These extra values are freely offered to both present and potential users of Cyanamid Reagents. A letter to our nearest office will bring prompt response.



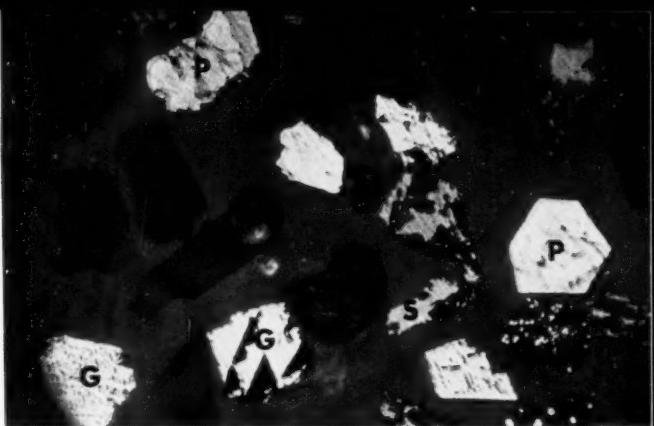
CYANAMID

AMERICAN CYANAMID COMPANY

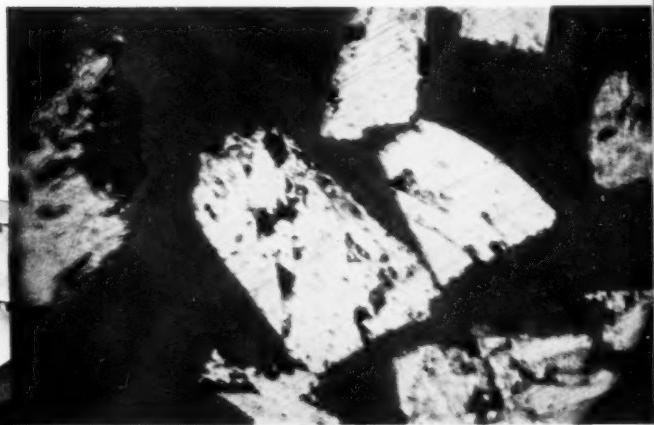
EXPLOSIVES AND MINING CHEMICALS DEPARTMENT

CYANAMID INTERNATIONAL — Mining Chemicals Department
Cable Address: Cyanamid, New York

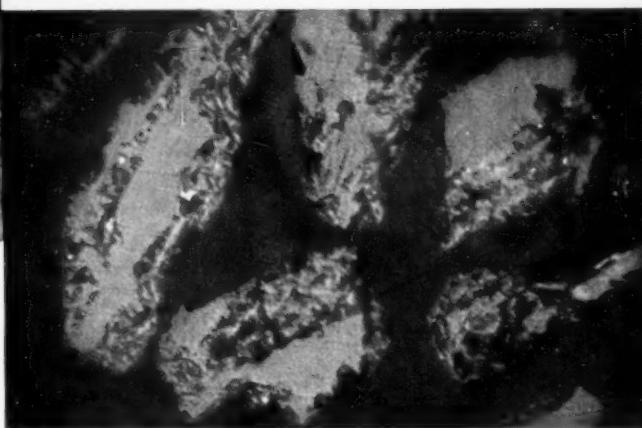
30 ROCKEFELLER PLAZA, NEW YORK 20, N.Y.



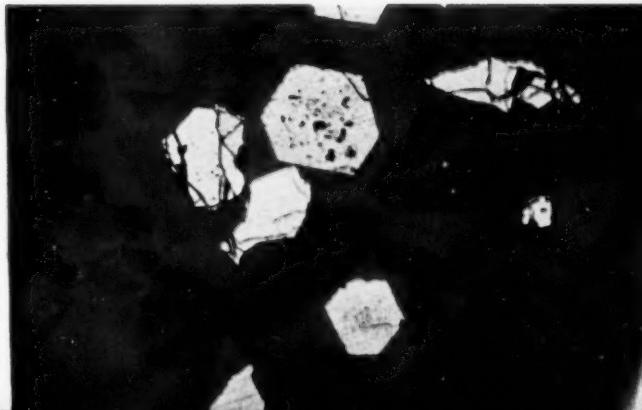
Photomicrographs are all of 100 x 500 mesh fractions of Rio Pallanga mill products. (G = Galena; P = Pyrite; S = Sphalerite.) Above shows mill feed (200 diameters). Dark minerals are calcite, quartz and dolomite.



Lead Concentrate (500 diameters)



Zinc Concentrate (500 diameters)



Tailings (200 diameters)



It's the payload that counts

New Curtiss-Wright Scraper Delivers 20% More than Rated Capacity!

... The chart at right tells the story ... Under difficult on-the-job conditions this Curtiss-Wright CW-226 *averaged* more than 5 yds. better than rated capacity ... moved this load at money-making speed — dumped swiftly and evenly ... This type of job-proven performance keeps cost-per-yard figures *down* — profit figures *up*! ... Every piece of Curtiss-Wright construction machinery is built to *earn* its price many times over — see your distributor today for complete information on the CW-226 and the many other units in the Curtiss-Wright line!

THIS ON-THE-JOB PERFORMANCE REPORT TELLS THE STORY

MODEL CW-226

2-axle, self-propelled scraper designed for rated capacities of:

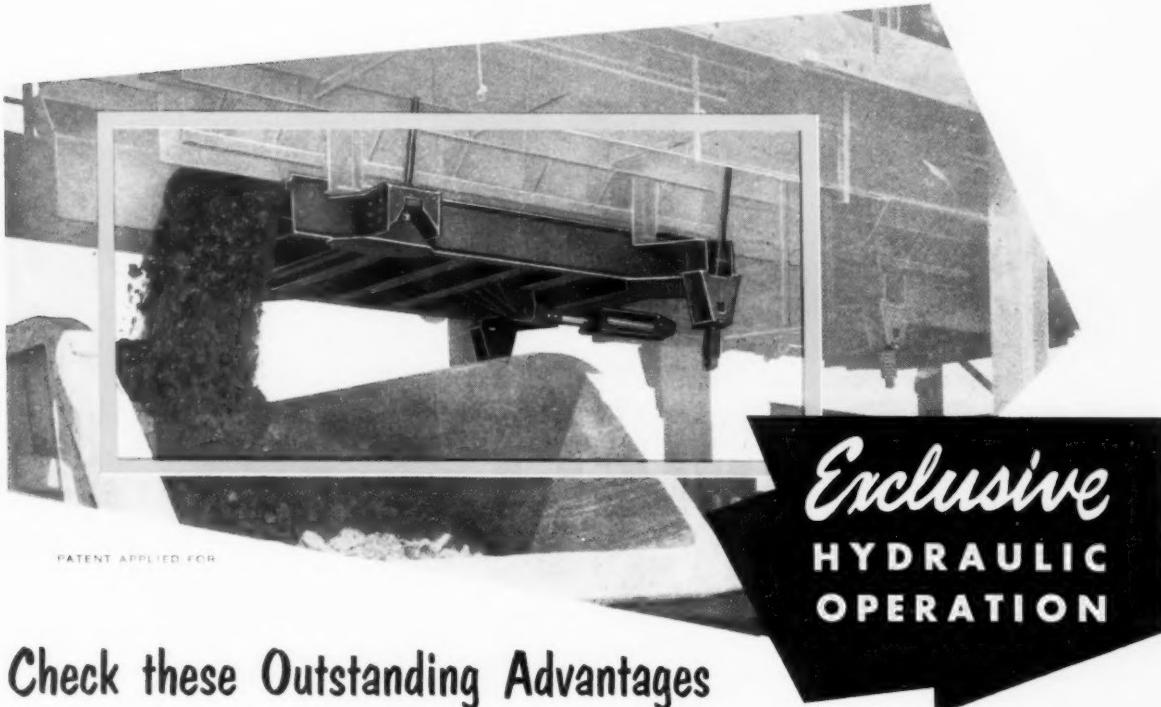
**26.0 Cu. Yds. Struck
36.0 Cu. Yds. Heaped**

Average Payload Hauled:	31.2 Cu. Yds.
Loaded Unit Speeds to:	38. m.p.h.
Average Loading Time: (with single pusher, less than top h.p. rating)	1 min., 30 sec.
(with tandem pusher)	50 sec.
Average Loads:	85,800 lbs.

SOUTH BEND DIVISION
CURTISS-WRIGHT®
CORPORATION
SOUTH BEND, INDIANA

HEAVY-DUTY HYDRASTROKE* FEEDER FOR MINES and MILLS

A Reciprocating High-Tonnage Feeder easily adapted to
feed Belts, Trucks, Skips, Railroad Cars, Screens and Crushers



Check these Outstanding Advantages

HYDRAULIC OPERATION

Exclusive hydraulic power drive supplies the fluid to a cylinder which reciprocates the deck. Fixed or variable feeding rates are easily available through the use of a fixed or a variable volume pump. Length of stroke can be varied from 6 to 24 inches.

MINIMUM HEAD ROOM

Head room requirements are reduced to as little as 20 inches. Impact damage is minimized because discharge lip of feeder is only 6 to 8 inches above lowest clearance line of feeder. Initial construction costs are reduced.

ROCKER MOUNTING OR SUSPENSION

May be installed with either rocker suspension or self-contained rocker mounted units. Eliminates costly wear due to friction which is present in other types of feeders. No lubrication is needed. Feeder can take severe shock loading.

Durability characterized by special rugged construction

Wide range of sizes available . . . widths from 36" to 96" . . . feeding capacities from 300 to 7500 tons per hour.

Write for illustrated brochure.

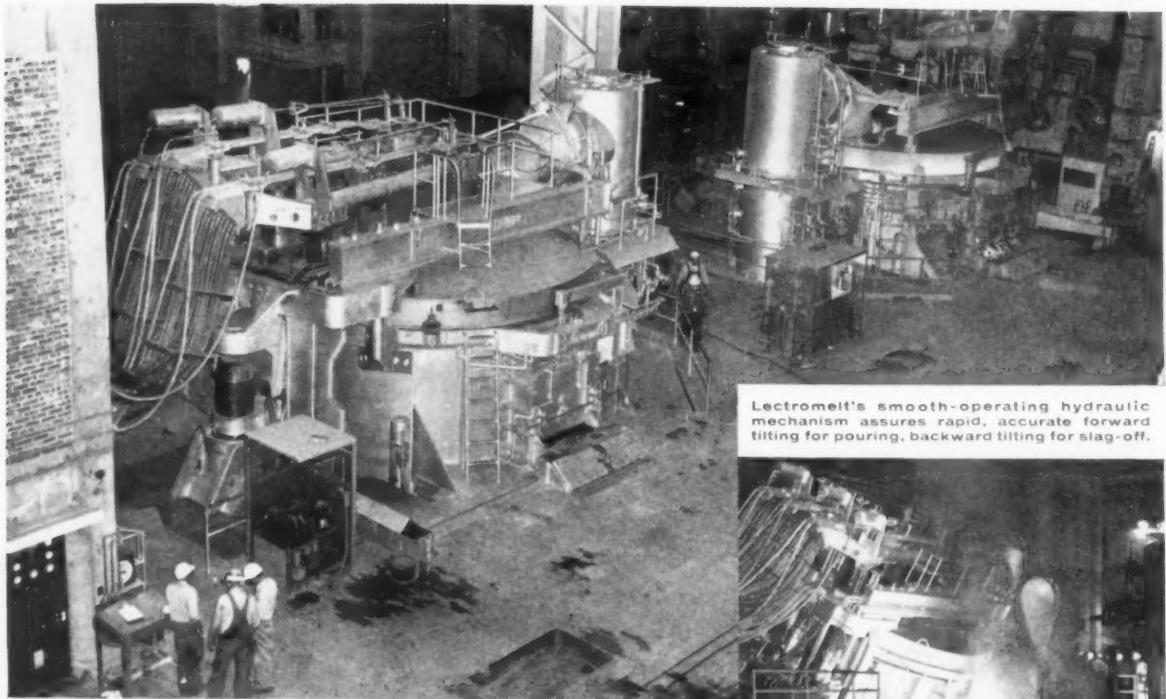


* TRADEMARK

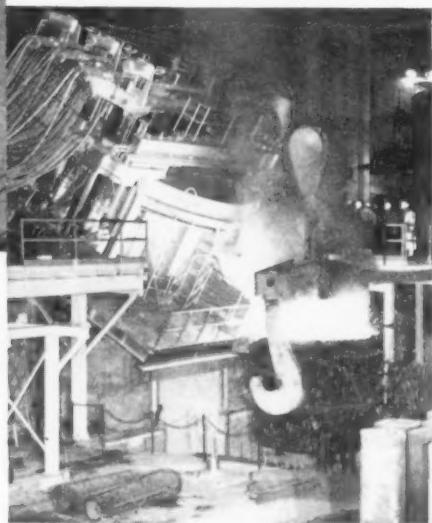
NATIONAL IRON COMPANY

50th Avenue West At Ramsey Street

Duluth 7, Minnesota



Lectromelt's smooth-operating hydraulic mechanism assures rapid, accurate forward tilting for pouring, backward tilting for slag-off.



LECTROMELT FURNACES

replace open hearths...

increase ingot capacity 70%

...lower production costs

Lectromelt®

CANADA: Canefco Limited, Toronto . . . ARGENTINA: Master Argentina, Buenos Aires . . . ITALY: Forni Stein, Genova . . . ENGLAND: Electric Furnace Co., Ltd., Weybridge . . . GERMANY: Demag-Elektrometallurgie, GmbH, Duisburg . . . SPAIN: General Electrica Espanola, Bilbao . . . FRANCE: Stein et Roubaix, Paris . . . BELGIUM: S.A. Stein & Roubaix, Bressoux-Liege . . . JAPAN: Daido Steel Company, Ltd., Nagoya

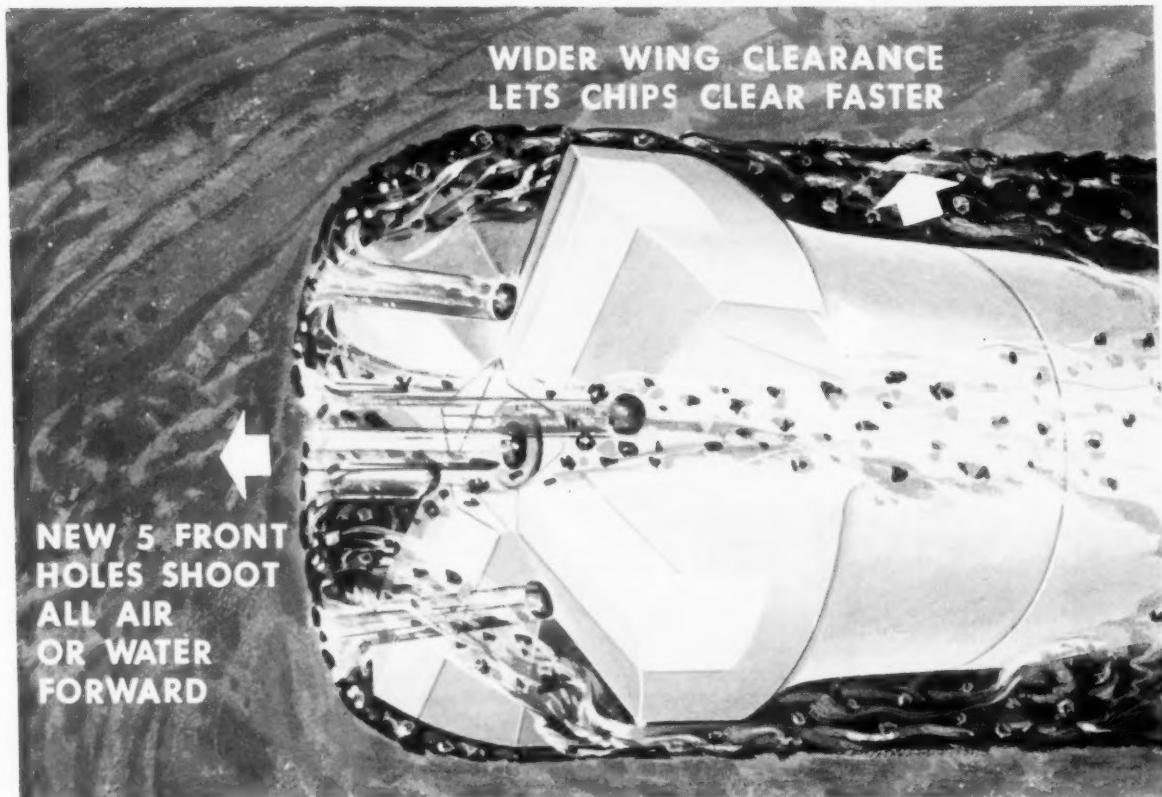


For complete technical data—ask for a copy of Catalog 10. Write Lectromelt Furnace Division, McGraw-Edison Company, 324 32nd Street, Pittsburgh 30, Pa.



For drifters, sinkers and stoppers...

New TIMKEN® threaded bit spends less time "drilling" chips, more time drilling rock



The diagram above shows how the new Timken® threaded carbide bit spends less time "drilling" chips and more time drilling rock—gives you more hole-per-bit. That's because 1) the new Timken threaded carbide bit's newly positioned 5 front holes direct all air or water with jet-action against the rock face and 2) the deeper, wider wing clearance lets chips clear faster. And the deeper relief under the heel allows even more clearance for washed-back chips. This speedier chip removal ends the problem of clogged drill steels and protects bit skirts against damage.

You save even more because new special analysis carbides in the new Timken threaded bit give it greater

wear-resistance with added shock-resistance. They can be reconditioned many times. The redesigned heavier wing helps drilling go faster. And the improved thread contact cuts breakage to the lowest point.

For more hole-per-bit on drifters, sinkers and stoppers, use the new Timken threaded carbide bit. Write for free brochure that gives all details. The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable: "TIMROSCO".

FOR OTHER TOUGH DRILLING JOBS



IMPROVED TIMKEN
MULTI-USE BIT

with correct, controlled reconditioning, gives lowest cost per foot-of-hole when full increments of steel can be drilled.

NEW TIMKEN
TAPERED SOCKET BIT

The air-leg bit of the future—here today! Removable for full steel life. Tapered for more secure union. Same new frontal features as threaded bit.

REMOVABLE
ROCK BITS

TIMKEN
TRADE MARK REG. U. S. PAT. OFF.

Right off the *Wire*

A miniature record player only four by eight inches is capable of playing twelve inch records.



The record of many thousands of electrical installations shows that the use of TIREX cords and cables provides an extra measure of employee safety.



A new process removes helium from natural gas, in which it is a contaminant, by passing the gas through glass pipes, through the walls of which the helium is filtered.



An atomic-powered train has been designed that will travel across country without tracks. It has fifty-two wheels, each of which is electrically driven.



The plastic base of a new electric coffee pot completely encloses and waterproofs both heating element and thermostat.



Titanium alloyed with ranadium, chromium and aluminum makes a new alloy that is said to have the greatest strength for its weight of any structural material.



A complete picture, ready for transmission, is provided by a new transistorized television camera. It weighs only four pounds, including self-contained control and synchronizing units.



A radio telescope over four-hundred feet in diameter is planned for the hills of West Virginia.



Weather information can be transmitted over a thousand-mile range by an automatic radio station which can be dropped anywhere by an airplane.



An automatic electronic inspection machine makes a four-way check of automobile valves at the rate of 3,000 per hour with a tolerance of five millionths of an inch.

An adhesive has been developed that will retain a metal-to-metal bond at temperatures as low as -253 degrees C.



All cords and cables give better service when handled properly. TIREX® portable cords and cables, although jacketed with fortified and tempered neoprene armor and "lead cured" for toughness and smoothness, will give still longer service if not subjected to unreasonable abuse.



By making jet nozzles radioactive and measuring the radiation from the fuel passing through them, the amount of wear can be measured to within one millionth of a gram per hour.



Further information on these news items and on Simplex cable is available from any Simplex office. Please be specific in your requests.



A miniature battery which is reported to last for five years, uses the radioisotope Prometheum 147. It is suitable for hearing aids, watches or missile guidance systems.



In California, it is proposed to use underground steam to generate electricity as is being done in Italy and New Zealand. Wells are now being drilled and a yield of 100,000 kilowatts is anticipated.



Two radio manufacturers have built extra service into their sets. One warns of approaching tornadoes and the other acts as a radiation detector.



Deuterium, or heavy hydrogen, is concentrated by some bacteria from sea water. This discovery may lead to a new and inexpensive method of producing the heavy water used in reactors.

The area behind the eye that can not be examined by other instruments can now be seen by a device that uses penetrating sound waves and converts their reflection into light.



A disposable medicine container of heat-proof plastic doubles as a hypodermic syringe.



Our atmosphere at an altitude of sixty miles is now known to contain chemicals which could serve as an unlimited fuel supply for ramjet engines.



What's in a name?

The character and business integrity of distributors are measured to a great extent by the products they handle. More than 1000 of the nation's most successful electrical firms — offering the utmost in customer service and satisfaction — recommend and sell Simplex TIREX cords and cables.

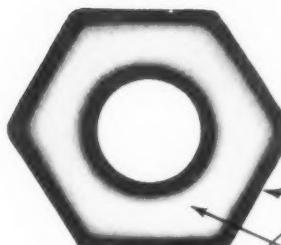
SIMPLEX WIRE & CABLE CO.
Cambridge, Massachusetts and
Newington, New Hampshire

Simplex

"The American manufacturers of transoceanic telephone cables"

GARDNER-DENVER DRILL STEEL

Cuts drilling costs...reduces steel breakage

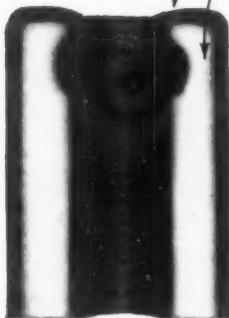


Made like tough rock drill parts

Gardner-Denver sectional drill steel is carburized to produce the same hard case, soft core structure that produces superior rock drill parts. Shot-peening increases fatigue resistance.

High-tensile surface strength resists abrasion, corrosion, nicking and down-the-hole gaff.

Tough, soft core provides compressive strength to withstand shock loads without breaking.



Made from quality steel

Gardner-Denver uses special alloy steels to insure uniform hardening and longer service life.

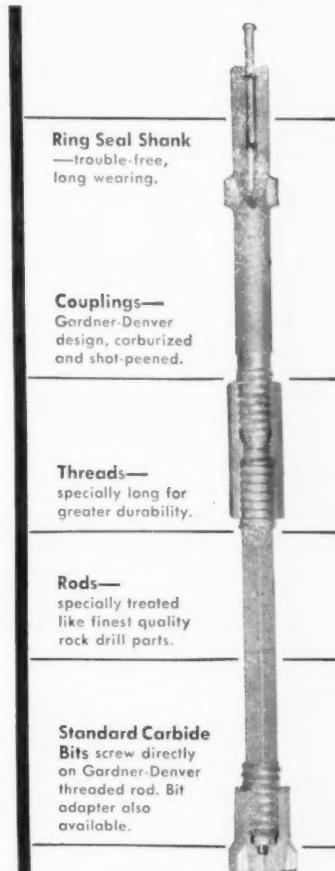
Threads and couplings designed for the job

The extra long threads and couplings of Gardner-Denver design provide greater strength and durability. Couplings are also carburized to provide a hard surface on the threads and a tough core.

Proved on the job

One user drilling hard rhyolite reports steel breakage reduced by 45% after changing over to Gardner-Denver drill steel.

Drill steel represents a large percentage of drilling costs. Gardner-Denver drill steel costs less to use. Write for information.



Gardner-Denver Sectional Drill Rod Specifications

	CL5-200 Series	CL5-400 Series	CL5-600 Series	CL5-700 Series	CL5-1000 Series
Thread Size	1 1/16"	1 1/4"	1 1/8"	1 3/4"	2 1/2"
Recommended Drill Size	3" and smaller	4" and smaller	4" and 4 1/2"	4" and 4 1/2"	5 1/2"
Recommended Bit Size	1 1/8" to 1 1/2"	2" to 2 1/4"	2 3/8" to 2 1/4"	3" to 4"	4", 4 1/2" and 5"
Rod Sizes	5/8" Hex.	1" Hex.	1 1/4" Hex.	1 1/4" and 1 1/2" Hex.	1 1/8" Hex.
Rod Lengths	2' to 20'	2' to 20'	2' to 20'	2' to 20'	4' to 20'
Coupling Diameter	1 7/16"	1 3/4"	2 1/8"	2 1/2"	3 3/8"
Ring Seal Shank	1" Hex. Collared 1 1/4" Rd. Lugged	1 1/4" Rd. Lugged 1 1/2" Rd. Lugged	1 1/4" Rd. Lugged 1 1/2" Rd. Lugged	1 1/2" Round	2 1/2" Round



ENGINEERING FORESIGHT—PROVED ON THE JOB
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Gardner-Denver Company, Quincy, Illinois
Export Division, 233 Broadway, New York 7, New York
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Short-lived screens shoot holes in your profits

When you're screening hard, extremely abrasive materials by the ton, you want a screen that will *last*. Frequent screen failures mean frequent work stoppages for repairs or replacements . . . and that means higher cost-per-ton of material screened. To hold downtime to a minimum, specify screens that are "tailor-made" for long service life . . . CF&I Space Screens.

The steel in each CF&I Space Screen is chosen in accordance with its ability to perform under the specific conditions found on the job . . . for its excellence in resisting abrasion . . . vibration . . . fatigue, or any combination of these factors. Throughout every production step—from blast furnace to wire drawing and weaving—CF&I's careful quality-con-

trol procedures ensure long-lasting, accurate screening. And CF&I offers a wide range of screening specifications (see table) to satisfy various job requirements.

For prompt dependable service, complete information or engineering assistance, contact the CF&I sales office nearest you.

WEAVES

DOUBLE CRIMP—heavy screens, long life under toughest operating conditions

LOCK MESH—very accurate sizing

FLAT WEAVE—least resistance to material flow

OPENINGS

LONG SLOT—relieves blinding and clogging

RECTANGULAR—maximum throughput

SPECIFICATIONS

WIRE SIZE—.035" to 1" diameter, clear openings .063" to 6"

6119-B

Cut Downtime

WITH



SPACE SCREENS

THE COLORADO FUEL AND IRON CORPORATION



In the East: WICKWIRE SPENCER STEEL DIVISION—Atlanta • Boston • Buffalo • Chicago • Detroit • New Orleans • New York • Philadelphia

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Exclusive clam-action loaders pay big on shovel-type jobs



"Back-dragging" with exclusive clamshell action, the 3 cu. yd. TD-20 4-in-1 pulls down stratified layers of material by the truckload. This unit replaces big-capacity power shovel performance—loads out a 12 yd. truck in only three fast passes. In addition, this unit's clamshell action picks up and loads brush, stumps and boulders—provides earth-rolling bulldozer action for haul-road maintenance!

4-IN-1 acts like "40-IN-1" replacing costly, limited-duty rigs!

Simply lift the clam lip hydraulically with fingertip control—and full-capacity, big-yardage bulldozer action (with speedy Shuttle-Bar control) is instantly at your service. The TD-20 4-in-1 shown below is stockpiling 6 to 8 cu. yd. of material per pass. You'd need bona fide, full-sized blade outfit—or a fast-swinging dragline—to match the 4-in-1's earth-moving performance as a bulldozer!

Nimble International Drott 4-in-1's are snatching profitable jobs from "under the buckets" of far costlier boom-type rigs. Find out why! Get in the driver's seat. See what it means to command built-in clamshell, "carry-type scraper," bulldozer, and famous Skid-Shovel action. Measure the advantages of making only one moderate investment—and hiring only one operator—to get the performance of a yard-full of limited-duty equipment. See your International Drott Distributor for a demonstration of the 4-in-1 size you need!



Sticky clay quits sticking in the bucket—quits gumming the works and slowing production—when you use 4-in-1 clamshell bottom-dumping. Opening the clam pulls sticky materials from bucket surfaces—gravity does the rest, to give the 4-in-1 fast, positive self-cleanout. Even clinging materials that stop conventional "single-action" buckets cold are "duck soup" for the 4-in-1's clam action!

International Harvester Company, Chicago 1, Illinois
Drott Manufacturing Corp., Milwaukee 15, Wisconsin



INTERNATIONAL®
DROTT

"95" Payhauler fleet delivers 98.5% availability

highballing rock loads
over High Sierra grades

FOR SOUTHERN CALIFORNIA
EDISON CO., LOS ANGELES



Mammoth Pool Hydroelectric Project, of Southern California Edison Co., is on the upper San Joaquin river—deep in rock-ribbed, steep-pitched High Sierra country.

It's a job where heavy rock-moving equipment soon reveals what's in it—and behind it—matching power, strength, and positive control against mountain grades, rough haul roads, and high-altitude operation.

Through one measured 12-week period, the 10-unit International Payhauler fleet on this project delivered an amazing 98.5% work availability. Payhaulers are built, throughout, to meet slam-bang, off-road conditions!

For each ton of carrying capacity, a "95" Payhauler has 277 lbs. of main frame steel to give unmatched "backbone" strength. Payhauler semi-elliptic, free-float-



"95" Payhaulers are "horsing" their 24-ton rock loads up grades as steep as 18%—on the Mammoth Pool Project! The "95's" Turbo-charged diesel engine develops 335 hp—the 18-ton "65's" is 250 hp!

Here's part of the 10-unit "95" Payhauler fleet parked during noon-hour, that established the amazing 98.5% availability record on Southern California Edison's Mammoth Pool Project!

ing springs gain extra shock-swallowing support from extra leaves and extra length. Payhauler speeds match every load and road. And Payhauler exclusive integrally-forged full-floating planetary drive axles take full-torque loads without over-stress.

This extra built-in stamina helps International Payhaulers establish standout availability records. And so does ready availability of parts and service from your International Construction Equipment Distributor's well-stocked bin and well-manned shop—backed by factory warehouse parts reserves.

See how a Payhauler's bonus of Turbo-Charged diesel power assures you fuel-thrifty, big-load performance—even at high altitudes. Watch how power on Payhauler rear wheels helps deliver top operating efficiency on steep grades or mucky conditions—even where trailer-type units "spin their wheels." Prove that Torqmatic braking safely and positively controls the fully-loaded "95" downgrade—with little or no foot-brake help! See your International Construction Equipment Distributor for a demonstration!

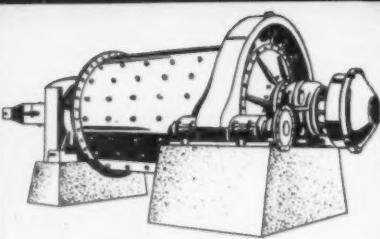
Two rock-loaded "95's" are on their way—while a third one spots its big-target body for the shovel. Five International Planet-Power steered TD-24's and 12 UD-6 International power units on generators also help make this \$50 million job roll!



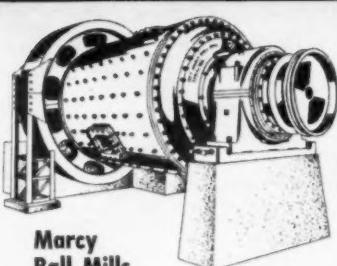
**International
Construction
Equipment[®]**

International Harvester Co., 180 North Michigan Avenue

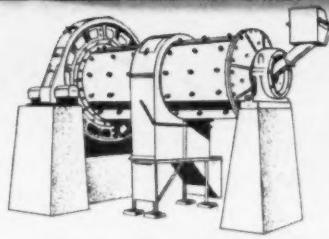
A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors... Self-Propelled Scrapers... Crawler and Rubber-Tired Loaders... Off-Highway Haulers... Diesel and Carbureted Engines... Motor Trucks... Farm Tractors and Equipment.



Marcy Rod Mills



Marcy
Ball Mills



Marcy CPD Rod Mills

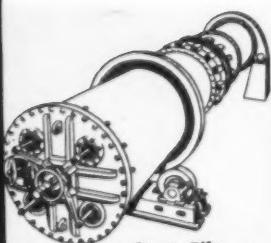
"No Compromise with Quality"

Your assurance of

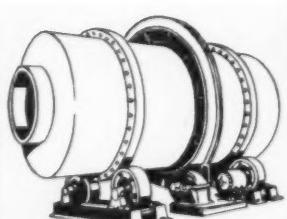
- low net-cost-per-ton production
- long operating life

* When Mine and Smelter started manufacturing Marcy Mills, 45 years ago, it established a policy of "No Compromise with Quality." That's why Marcy Mills have earned a worldwide reputation for dependable operation and economical grinding.

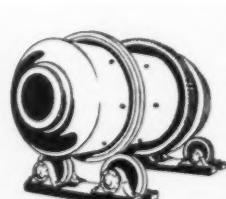
Now that the Colorado Iron Works Company has been merged with Mine and Smelter, the complete line of products shown here is available from one, integrated source...and, manufactured with the continuing policy of "No Compromise with Quality."



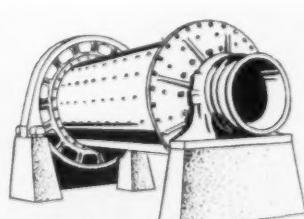
Burt Filters



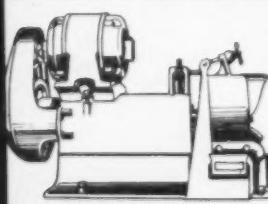
Fusion Furnaces



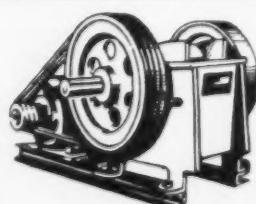
Leaching Drums



Scrubbers



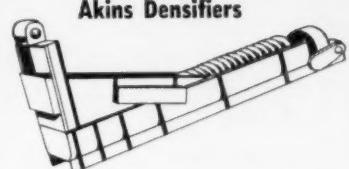
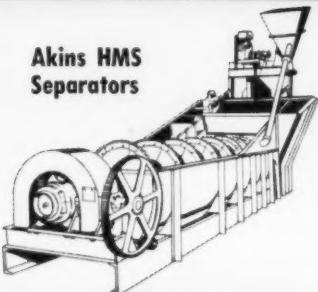
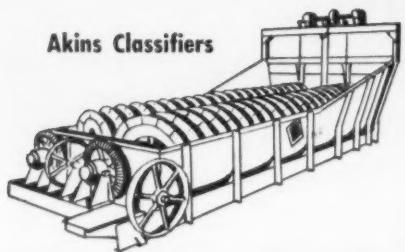
Massco-McCool Pulverizer



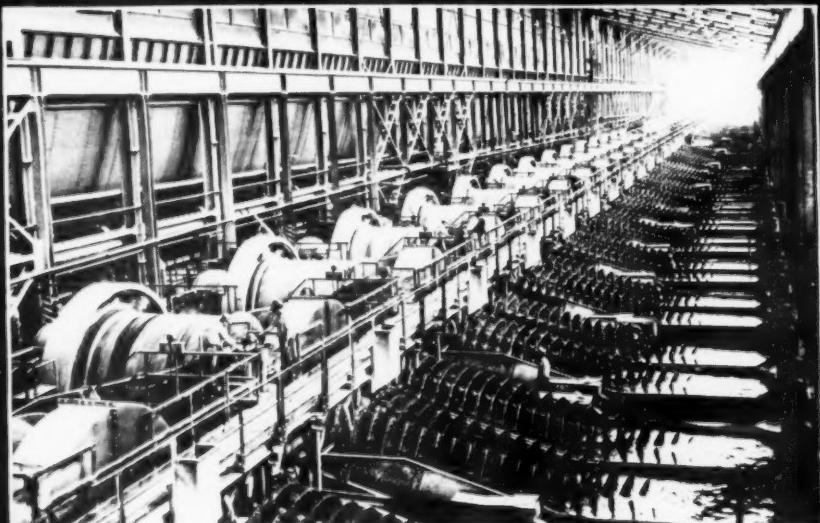
Massco Lab Jaw Crusher

Licensed Manufacturers and Sales Agents in Canada, Australia, Sweden, England and South Africa.

Sales Agents in Chile, Philippine Islands, Japan, New York City (for Continental Europe), and in the principal cities of the United States.



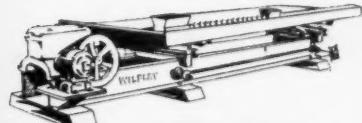
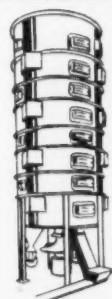
Esperanza Drag Classifiers



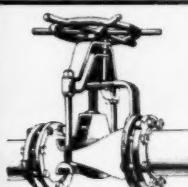
28 Marcys...56 Akins Working together for 15 years

This installation, in a large copper mill, is typical of that quality performance... 28 Marcy 10' x 10' Grate Discharge Ball Mills and 56, 54" Akins Duplex Classifiers have been giving dependable production, with minimum maintenance, for over 15 years.

Skinner
Roasters and
Dryers



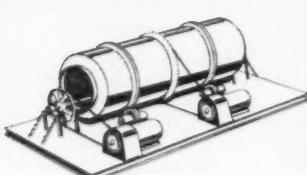
Wilfley Tables



Massco-Grigsby
Rubber
Pinch Valves



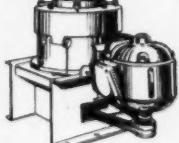
Marcy Pulp
Density Scale



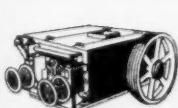
Pug Mills



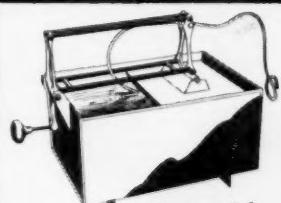
Vezin Sampler



Massco Gy-Roll
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Lab
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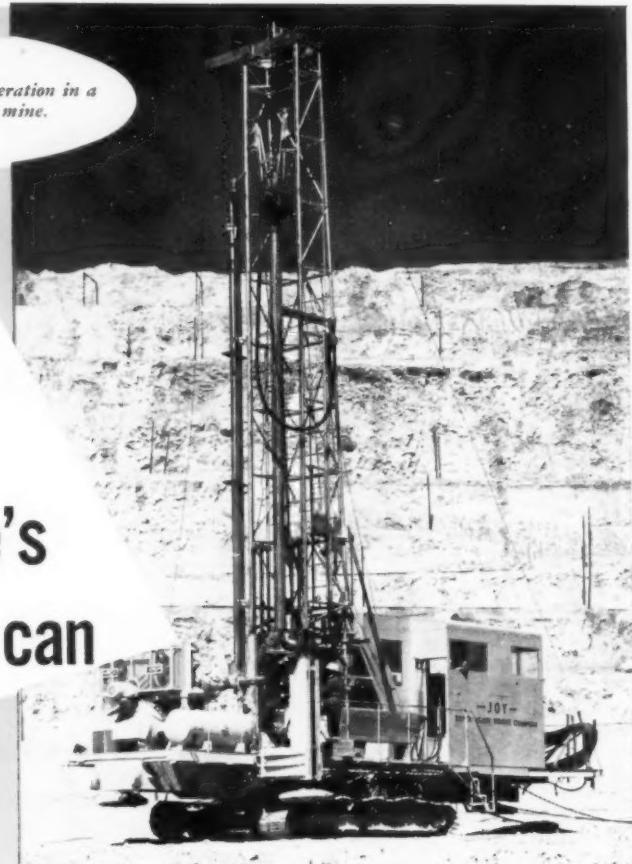
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12"
BLASTHOLES
drilled
CONTINUOUSLY
in any rock... Here's
the **ONLY** drill that can
do it!

Joy 60-BH Drill in operation in a large Southwest copper mine.



the **JOY 60-BH** Super Heavyweight Champion

Here's the champion at drilling larger, lower-cost blast holes where the going is tough and high production is a must. The Joy 60-BH Super Heavyweight Champion has the power, the stamina . . . the sheer muscle . . . to bottom blastholes fast, shift after shift, month after month, in hard or soft formations. And it can drill out of the hole, too, when necessary. Here's why the performance of this big drill cannot be matched—it excels in all three of the features which determine bit penetration:

STRONGER ROTATION—Up to 14,850 ft. lbs. of torque can be applied continuously and safely. Accurate control of infinitely variable bit speeds and constant indication by gauge.

HIGHER BIT PRESSURE—Joy hydraulic-feed method of applying bit pressure—gripping the rod at the most logical place, near the collar of the hole—permits con-

tinuous pressures up to 75,000 lbs.; assures more accurate control than other methods.

MORE EFFICIENT CUTTINGS REMOVAL—Only Joy uses a heavy-duty, industrial-type, water-cooled air compressor to insure an optimum, continuous air supply.

Other features . . . rod handling device to reduce heavy rod handling and the longest derrick available to reduce or eliminate rod additions.

Only Joy has a complete line of rotary air-blast drills:
56-BH 6 $\frac{1}{4}$ " maximum hole diameter
58-BH 7 $\frac{1}{8}$ " maximum hole diameter
59-BH 9" maximum hole diameter
60-BH 12" maximum hole diameter

*Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.
In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

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Core Drills



Slushers



Rock Bits



Drillmobiles

Mining World

THE IMPORTANT MINING MAGAZINE EVERYWHERE

November 1958

INTERNATIONAL PANORAMA

SAN FRANCISCO, CALIFORNIA—During the first six months of 1958 domestic production of uranium was 5,756 short tons of UO₂ from 2,471,000 tons of ore milled. Daily milling rate grew from 10,900 to 15,700 tons during the period.

HOBART, TASMANIA—The Electrolytic Zinc Company of Australasia Ltd. is making shipments of zinc to Hong Kong for further shipment to an undisclosed point.

SANTIAGO, CHILE—Andes Copper Mining Company is spending an additional \$23,580,710 to bring its new El Salvador copper mine into production early next year at a total cost of \$103,730,710.

METALINE FALLS, WASHINGTON—American Zinc, Lead and Smelting Company is sinking a new shaft to develop its Grandview lead-zinc 300 feet below the present workings.

TORONTO, CANADA—Advocate Mines, Ltd. and associates will spend \$1,000,000 to develop an asbestos ore body and build a 3,000-ton-per-day mill at the Baie Verte deposit, Burlington Peninsula, Newfoundland.

KELLOGG, IDAHO—Bunker Hill Company is increasing lead and zinc production. The lead smelter will operate six days a week instead of five and one idle unit will be started in the electrolytic zinc plant.

MONROVIA, LIBERIA—A 300-square-mile iron ore concession east of here has been awarded to the Exploration, Mining & Study Company by the Liberian government. The Exploration company is owned by West German steel producers.

MONTPELIER, IDAHO—Central Farmers Fertilizer Company has started open-pit phosphate mining at rate of 400 tons per hour. Ore is being stockpiled awaiting completion of an electric furnace to produce elemental phosphate.

RANGOON, BURMA—Mawchi Mines Ltd., large tungsten producer, has been closed by insurgents attacks.

BISBEE, ARIZONA—Phelps Dodge Corporation has increased copper production 1,700 tons per month by going to a 5½-day week. Output is now about 18,700 tons per week compared to maximum output of 22,500 in 1956.

LISBON, PORTUGAL—Beralt Tin & Wolfram Ltd. is expanding tin production by selective mining to offset lower income from tungsten sales.

SAN FRANCISCO, CALIFORNIA—The United States government is calling for bids to upgrade stockpile ferro alloy concentrates to ferromolybdenum, ferrovanadium, molybdc oxide, and tungsten carbide powder.

FRIENDSHIP, WISCONSIN—The Cleveland-Cliffs Iron Company has started diamond drilling in Juneau County to check magnetic anomalies found by University of Wisconsin engineers.

MOUNT ISA, AUSTRALIA—Mount Isa Mines Ltd. is making major additions to its copper smelter to increase capacity with a new reverberatory furnace and converter.

WASHINGTON, D. C.—Samarium metal, 98 to 99 percent, is now available commercially for first time in lump or ingot form. Its high cross section, 5,500 barns, has stimulated research for reactor use.

SAN FRANCISCO, CALIFORNIA—The United States Atomic Energy Commission has budgeted \$3,650,000 to finance research and development for everyday uses of radioisotopes useful to the national economy. MOSCOW, RUSSIA—Siberia's Yakutia diamond field has been extended by discovery of a rich diamond-bearing kimberlite pipe. The Udachmaya mine will be developed at this pipe.

NOYLES, GODAULT, FRANCE—Societe Miniere et Metallurgique de Penarroya is building an Imperial Smelting Corporation type zinc-lead blast furnace here to recover 30,000 annual long tons of zinc and 10,000 lead.

PORT HOPE, ONTARIO—Canada has produced its first uranium metal. The metal was produced from Canadian concentrates by Eldorado Mining & Refining, Ltd., the Canadian government's uranium firm.

New Office of Minerals Exploration Replaces DMEA

The Office of Minerals Exploration has been established by the Department of the Interior to carry out the provision of Public Law 701 for Federal assistance in financing exploration for new or additional mineral reserves.

It succeeds the Defense Minerals Exploration Administration. The DMEA program expired on June 30th, but the OME will assume responsibility for DMEA contracts still in force and each project certified by the DMEA as a discovery or development. \$4,000,000 has been approved by Congress for the OME operation in 1959.

The OME program will differ from the previous DMEA program in three important aspects: applicants must provide evidence that funds cannot be obtained from commercial sources on reasonable terms; interest will be charged (2.0 percent instead of 20.0 as erroneously reported in October *Mining World*) from the dates Federal funds are disbursed to operators; and government participation in any one contract may not exceed \$250,000.

The new program is not intended to provide Federal funds for exploration projects that would ordinarily be undertaken by the applicant, at his sole expense, under current conditions or circumstances. The primary purpose of the program is to share with private industry the risks involved in carrying out those exploration projects which have good potential but which normally would not be undertaken with private capital.

France To Get Its First Direct Smelting Furnace

The first blast furnace outside of England for direct smelting of mixed charges of zinc-lead-bearing material to yield metallic zinc and lead bullion will be built at Noyelles-Godault, France by Societe Miniere et Metallurgique de Penarroya.

The zinc blast furnace was developed by S. W. K. Morgan and associates at the Imperial Smelting Corporation Limited's Avonmouth, England smelter. This new process was considered so significant that Mr. Morgan was awarded the *Mining World "Technical Achievement Plaque"* for 1957 for his part in this development.

The new Penarroya plant will burn 90 to 100 tons of carbon per day to produce about 30,000 long tons per year of metallic zinc, and 10,000 long tons of lead bullion. Penarroya conducted smelting tests on its concentrates and ores at Avonmouth before deciding to build a plant in France. The existing smelter at Noyelles-Godault has two lead blast furnaces and a horizontal retort zinc plant.

Abbott Mine Gets A New Lease On Life Through Interpretive Geology



WORKED-OUT THEORY EXPLODED by recent exploration successes at the Abbott mercury mine. The above photo shows Fred Hanson, geologist, and C. O. Reed (right), manager, studying geological map.



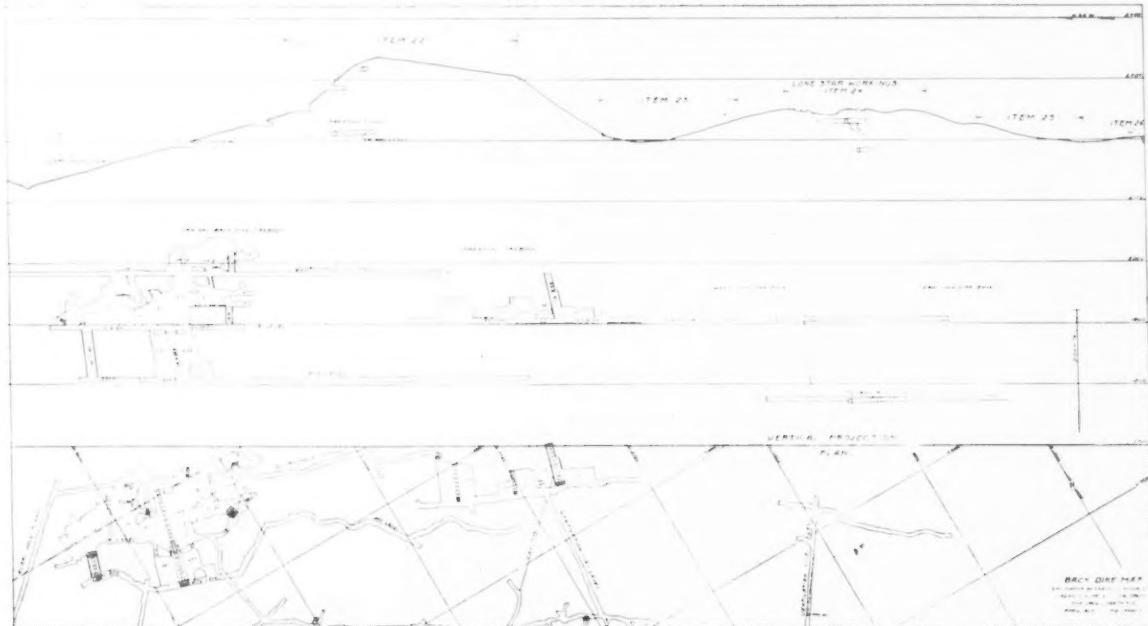
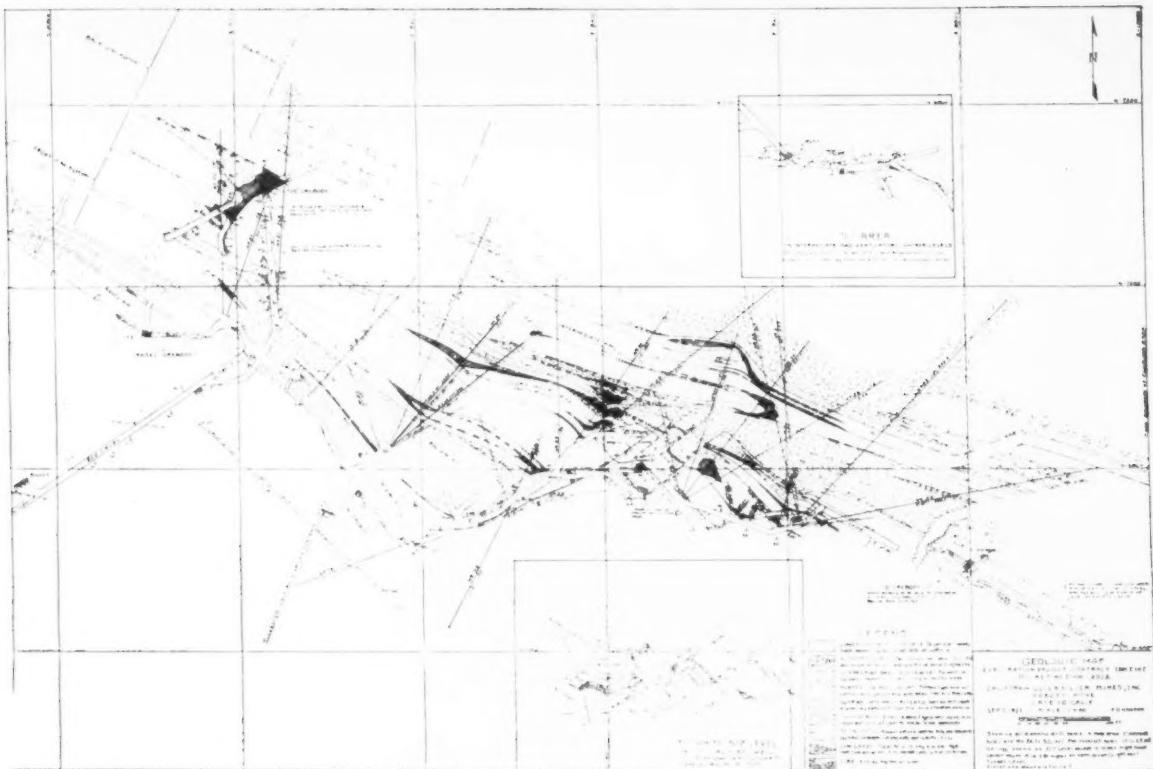
MINE BOASTS A 96 YEAR HISTORY and ranks about tenth among California mercury mines in all-time production. It was idled following World War II, and many thought that the ore was exhausted.

Editor's Note: COG Minerals Corporation has just recently taken over all assets of California Quicksilver Mines, Inc., and the latter organization has been dissolved. The mine is now operated by COG Minerals of Denver, Colorado.

During three distinct periods in its 96-year history, the Abbott mine near Wilbur Springs, California, had been an important mercury producer. In total production it ranked about tenth among California mines. Past mining, however, had apparently exhausted all major possibilities by 1950. Only a few possible extensions of known orebodies remained, together with a long virgin stretch where weak cinnabar showings had been unattractive to earlier operators.

Now it appears that California Quicksilver Mines, Inc. has possibly doubled the potential of the underground property. A recent series of exploration projects, in which funds from the Defense Minerals Exploration Administration played a major role, has been highly successful. A new ore zone has been discovered. It occurs at the contact of shale and silicified serpentine breccia northeast of and parallel to the structure which had furnished all of the known production of the mine prior to 1951. This newly disclosed structure, termed the Back dike, hosts small mercury deposits comparable in grade and size to the known, productive Front dike system.

The importance of the discovery is easily catalogued. It has furnished 98 percent of the mine's output for the past six years. For the first time in recent years, the mine has adequate ore reserves ahead of the stope furnishing production. California Quicksilver Mines, which acquired the property while idle in 1951, can now keep two 35-ton-capacity Saracco (Gould-type) rotary furnaces charged



Successful Exploration Reveals Ore in Footwall of Front Dike

BOTTOM MAP represents southeastern extension of the upper map. Discoveries were made at approximate intervals of 500 feet starting at the "19" orebody

(upper map) and progressing southeast in the Back Dike zone. It had previously been unattractive to former operators of the property.



MOST STOPES at the Abbott property are relatively flat-lying and have a weak hanging wall of gouge or soft shale. Sets are framed in the shop shown in the above photo.

with ore averaging 8 to 11 pounds of mercury per ton.

DMEA exploration has so enhanced the potential of the property that the Abbott mine may possibly be ranked as California's second most important known mercury source. Four major ore bodies have been stope since DMEA exploration started; three were within the contract area. Indirect results of the program have been highly beneficial. The Back dike had only been explored and partially developed along 30 percent of its 6,600-foot strike length at the end of 1957. Geological data collected by the end of 1957 had indicated a total of 15 possible ore bearing zones yet to be explored. Through DMEA aid, California Quicksilver has been able to maintain steady production during the contract years. At the end of 1957, ore reserves had grown to a three-year supply.

Perhaps most important of all is the fact that production from contract discoveries has repaid the government for funds advanced to California Quicksilver. At that, the potential value of future production from the newly disclosed, favorable, geological structure far outweighs the cost of the program. Though DMEA undertook a major share of the expense of exploration, credit for the successful discovery of unknown ore must go to the management and staff of California Quicksilver. The management had the courage to gamble sorely needed funds. The skill of the staff was responsible for interpretive geology which resulted in the discoveries.

Geologic Setting

The main structural feature of the property is a broad, northwest trend-



EIMCO MUCKING MACHINE is shown working off the sill of a stope. Over 95 percent of the output of the mine since 1953 has come from newly discovered Back Dike zone.

ing serpentine dike and sill complex about 2½ miles long. The width varies from 275 feet to ½ mile. Present opinion is that the dike system was originally intruded as peridotite into underlying Jurassic rocks and subsequently forced upwards as a serpentinized breccia into the outcropping Lower Cretaceous sediments on the southwest flank of the Wilbur Springs anticline. The anticlinal axis is oriented to the northwest and it plunges to the southeast. The dike complex has been fractured and shattered by deformation. In general the serpentine dike system dips to the southwest. It is made up of two, roughly parallel, main members, each a complex dike system. This condition was not recognized until 1951 and after.

The Abbott property is characterized by ideal conditions for mercury deposition. The host rock is a brecciated serpentine and it is permeable, while the hanging wall shales are relatively impervious to solution penetration. Local structural conditions caused by folding or faulting provided good structural traps for ore near the numerous shale-serpentine contacts. This same condition, however, resulted in the formation of many discontinuous and individual deposits in the hanging wall zones. None of the ore bodies found to date have extended more than 600 feet vertically below the outcrop of the dike in which they occur. The cost of exploration and development is complicated by these factors. An ore body of 40,000 tons would be classified as very large at this mine. Most of the minable deposits range in size from a few hundred to 35,000 tons.

All of the known ore bodies have been found in serpentine beneath a protective hanging wall of shale gouge. Mercury mineralization occurs mainly in cross fractures trending at nearly right angles to the hanging wall. These cross fractures are contained in portions of the serpentine breccia which have been hydrothermally altered to a tough and competent rock locally called "tuffoid." It is actually a variety of silicate-carbonate rock which varies from masses of black opalite to mixtures of opalite with carbonate minerals and other alteration products of serpentine.

Mineralization

Cinnabar is the predominant ore mineral. It is found in a variety of forms varying from solid veinlets and irregular masses to scattered crystals and to very thin powdery films of paint. Meta-cinnabar is also found though in most cases it is a minor accessory ore mineral.

Nearly all of the iron sulphides associated with the mercury deposits occur as marcasite. Solid and liquid hydrocarbons have been found—sometimes in sufficient quantity to affect furnacing of the ore. The gangue includes carbonates and siliceous minerals associated with the altered serpentine. Opal often has replaced masses of the silica-carbonate rock hosting the ore bodies.

The various minerals making up an ore body show a zonal relationship. This has been an important guide to exploration at the mine. The zonal arrangement has been observed both in small fractures mineralized on a vertical scale of 5 to 10 feet and also in major ore bodies of the property.

The sequence, starting from bottom to top, includes: quartz and magnesium carbonates, opaline silica, marcasite, metacinnabar, cinnabar, hydrocarbons, and calcite. All of the

mined-out ore bodies at the Abbott property have been bottomed by marcasite. Similarly, the occurrence of calcite veinlets may indicate the upper terminal of important ore mineralization.

Structural Control

At the Abbott mine four structural controls have been found to exert considerable influence over the formation of minable quantities of ore. A flattening or monoclonal fold in the hanging wall of the dike or sill results in localization of ore; similarly a flat dipping thrust fault which either terminates or displaces the serpentine dike often provides a good structural trap. A plunging inverted V at the junction of the hanging wall of a dike or sill and a cross fault is still another important structural control. Anticlinal folds or domes in the hanging wall also constitute good ore localization features. Where a dike or sill terminates upward in the shale, conditions are favorable for ore deposition. Ore also forms in an acutely angled, inverted V resulting from the convergence of a fault on one side with the hanging wall of the serpentine.

Prior to 1951, the serpentine dike complex associated with the ore bodies had been considered to be a single broad zone with local branching and inclusion of shale. Earlier exploration of footwall areas of some of the branching dikes had never divulged significant mineralization. For years only the hanging wall branches of the so-called "broad" serpentine zone were regarded as favorable for locating ore bodies.

First Clue of New Ore Zone

Then in the latter part of the 1940's the U.S. Bureau of Mines conducted a limited drilling program. Holes were bored into the southwest hanging wall of the dike system. Curious results were recorded in two of the holes which cross-cut the structure. In an area, which on the surface appeared to be solid serpentine, the holes first passed through a band of serpentine. They then entered and passed through 144 feet of shale and finally cut another 22 feet of serpentine. The final dike showed some evidence of mineralization. The cores contained opalite, some marcasite, and a little cinnabar which assayed only 0.8 pounds of mercury per ton.

It wasn't until nearly three years later, in 1951, that the significance of these diamond drill results began to take on a pattern. At this time, following both company and DMEA

Discoveries Outrun Expenses

The figures in the tables show that the government expenditure amounted to \$116,773 between 1951 and 1957. During this same period production of mercury, from ore bodies delineated and lying within the contract area, amounted to \$2,057,704. Total production of mercury since 1951 when California Quicksilver took over the property amounted to 10,128 flasks.

Under the terms of repayment, a royalty of 1½ percent is paid on all ore worth less than \$8.00 per ton. On ore over \$8.00 per ton, the royalty repayment amounts to 1½ percent plus ½ percent for each \$0.50 in excess of \$8.00. The exploration work financed by the government is paying its own way based on the production figures outlined in the table. Not only has the DMEA program been successful from the standpoint of production and ore reserves, but indirect results have been highly beneficial. Geological information gained from the DMEA work has proven another ore structure capable of hosting ore bodies.

How Expenditure, Production, and Reserves Balance Out at California Quicksilver Mines, Inc.

Approved DMEA contract expenditure original contract signed (Sept. 1951)	\$ 39,440.00
Approved DMEA contract expenditure 1st amendment signed (June 1953)	49,500.00
Approved DMEA contract expenditure 2nd amendment signed (April 1956)	\$1,502.10
	\$170,442.10
Total approved DMEA contract expenditure	
Actual expenses incurred for DMEA work on contract signed (Sept. 1951)	\$ 39,440.00
Actual expenses incurred for DMEA work on contract signed (June 1953)	42,597.90
Actual expenses incurred for DMEA work on contract signed (April 1956)	\$73,659.55
Total expenses for DMEA work	\$155,697.45
Government share of expenses @ 75 percent	\$116,773.09
Company share of expenses @ 25 percent	\$ 38,924.36

Ore Reserves as of the end of 1957

	Positive Ore	Probable Ore	Total Ore
Back dike system			
Back dike proper	15,100	27,550	42,650
"17" dike	1,300	5,600	6,900
"19" zone	950	5,770	6,720
Front dike system	850	11,850	12,700
Total Reserves	18,200	50,770	68,970
Reserves in contract area	17,150	38,300	55,450

Mine Production from 1952 through 1957 (all within DMEA contract area with exceptions noted)

	Tonnage Furnaced	Lbs. Hg per ton	Flasks Produced	Average Price	Value (Flasks x Average Annual Price)
1952	3,814	11.92	598	199.1	\$119,161
	(8 months only)				
1953	9,673	9.50	1,210	193.03	233,566
1954	9,764	17.09	2,195	264.39	580,336
1955	13,461	9.06	1,604	290.34	465,605
1956	14,994	8.88	1,752	260.00	455,520
1957	22,595	9.31	2,769	247.00	683,943
Totals	74,301	10.36	10,128		2,538,131

Total production from contract area - 7,837 Flasks valued at \$2,057,704.

exploration, it was suspected that perhaps the shale band might extend the full length of the property, separating the dike complex into two main members. Previously there had been only slight surface indication of this condition. Along most of the length of the dike structure, the separating shale band did not outcrop. The contact was thus regarded as an unimportant shear. In other portions of the strike length, the separating shale band was obscured by float. To make a long story short, subsequent company and DMEA exploration proved the existence of a footwall member of the serpentine zone. It was termed

the Back dike and the hanging wall member was called the Front dike. Since the Back dike was also favored with a shale hanging wall, it posed an excellent area for exploration.

Ore Found in Back Dike

In the early summer of 1951 it was decided to apply for a DMEA loan covering a 900-foot stretch of Front dike footwall.

A drilling program was laid out and submitted to the DMEA. The proposal included 23 diamond drill holes with an aggregate total of 3,815 feet which would involve an expendi-

ture of \$39,440. The government share was to be 75 percent or \$29,580. During the time that DMEA had the proposal under consideration, California Quicksilver started drilling on its own account. Holes No. 19 and 23 at the west end of the area encountered commercial ore. At the time, however, it was unknown whether both holes were in the same ore body.

In the meantime the proposed contract was signed in September 1951. The area covered was southeast of the company holes. Actual work done under contract amounted to 27 diamond drill holes for a total footage of 4,372 feet. The expenditure, however, fell within the contract limit of \$39,440. Average performance figures for this portion of the contract work were: 16.1 feet of hole per shift; 61.4 percent core recovery; and an average cost of \$9.02 per foot. The DMEA work was completed near the end of April 1952.

The cores resulting from the DMEA contract drilling didn't show any commercial ore, but they did reveal some seven or eight mineralized zones. Cores from the mineralized area carried a little cinnabar along with encouraging amounts of opalite and marcasite. Geological relationships and favorable structural features indicated that some of the seven or eight zones could contain commercial ore bodies. The known irregular distribution of ore bodies added further strength to the fact that commercial ore could possibly exist in some of these mineralized areas. Also, it was known that drill holes could penetrate an ore body without showing commercial grade ore in the recovered core.

Upon completion of the contract work, California Quicksilver drove

along the line of No. 19 hole. Work in this area resulted in the discovery of the "19" ore body. As it turned out the "19" ore body was located on a branch of the Back dike system. The "19" ore body was stoped from May 1952 to May 1954 between the 130 and 300 levels of the mine. Some ore continues below the 300 level and will be explored at a future date; the probable upward extension of the "19" will be probed. Though outside the contract area, the "19" ore body yielded 16,254 tons of 10.61 pounds per-ton mercury ore. This ore was furnace at the mill which was installed at the property in 1941.

Second Ore Body Found

About a year after the completion of the contract drilling program, DMEA indicated a willingness to aid in financing underground exploration of some of the mineral showings to the southeast found by the drilling program. The original contract was then amended to cover this underground exploration. This work included the reconditioning of 815 feet of the 200 level, and the driving of 1,478 feet of drifts, cross-cuts, and raises. The amended contract was signed July 14, 1953. It provided for the expenditure of \$49,500 bringing the total contracted DMEA work under the completed drilling project and projected underground exploration to \$88,900. Again the government share was 75 percent.

Actual work on the new project started in September 1953 and was terminated on June 30, 1955. Several additional amendments were necessary to extend the time limit and to permit necessary or desirable changes in the location of the work. The 200 level exploration confirmed the drill-hole findings, but disclosed only a

25-foot-long ore body on that level. Mineral and geological conditions, however, indicated that there was a good chance for finding ore above the level. Further development overhead revealed the Original Back dike ore body which ultimately became a very good producer for the mine. It was located some 400 to 500 feet southeast of the "19" discovery.

Stoping of the Original Back dike began in February 1954. From that time through June 1955, the Original Back dike deposit produced 12,586 tons of ore averaging 15.15 pounds of quicksilver per ton. The furnaces yielded 190,626 pounds or 2,508 flasks of mercury from this run.

A Third and Fourth Discovery

The Original Back dike discovery ultimately yielded a total of 32,451 tons of 10.94-pound ore. In addition subsequent DMEA exploration to the southeast of the Original has disclosed ore which has been mined in the 1956-57 period.

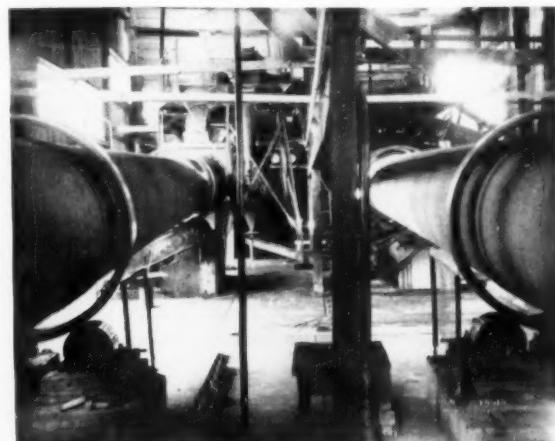
The success of the exploration which led to the discovery of the "19" ore and the contract discovery of the Original deposit encouraged further exploration to the southeast. On April 10, 1956, a second amendment was written into the DMEA agreement which essentially extended the DMEA target area. The boundary area again was expanded to the southeast.

This contract was divided into three broad stages which were to consist of approximately 7,400 feet of diamond drilling and a total drift, raise, and cross-cut exploration of 1,350 feet. The indications revealed by any one stage would determine the targets where efforts should be concentrated in the subsequent stage. If

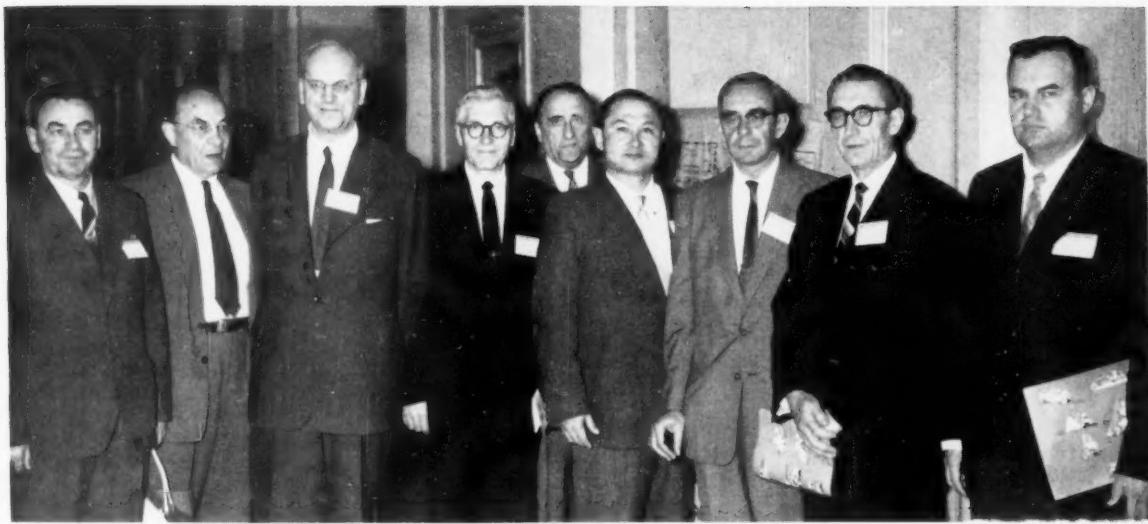
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VIEW OF SURFACE PLANT at the mine is shown in this picture. Exploration and development at the Abbott has been expensive because of dispersed nature of orebodies.



GOULD TYPE rotary furnaces are 42 inches in diameter by 50 feet long. Condensate is treated with quicklime in a mechanical hoisting machine.



Mining World Photograph

RUSSIAN IRON MINERS AND METALLURGISTS pose for this special picture during their recent visit to United States mines and mills. From the left are: Ivan Semenovich Sheetov, Magnitogorsk; Alexander Logofelt, interpreter; Andre Borisovich Patkovsky, Leningrad; Ivan Yakovlevich Grischouk,

Kharkov; Harry P. Brooks, interpreter; Rashid Abdullovich Kadyrbaev, Kustanay; D. N. Vedensky, M. A. Hanna Company (member of United States delegation to Russia); Mikhail Aleksandrovich Pokrovsky, Moscow (the group leader); and Ivan Ivanovich Savitsky, Krivoy Rog. They have returned to Russia.

Russian Iron Miners Tour U.S.

Six leading Russian iron ore miners and metallurgists have returned to the Soviet Union after spending a month visiting United States iron mines and beneficiation plants.

They were part of a 19-man exchange group sponsored by the American Iron and Steel Institute at the request of the United States government. A report of the highlights of the similar exchange visit by United States' delegates and their impressions of the Russian iron and steel industries appeared in the October 1958 issue of *MINING WORLD*, pages 36 and 37.

The iron ore specialists of the exchange group were conducted on their coast-to-coast tour by representatives of the American Iron Ore Association who set up the itinerary and arranged mine and mill inspections. Interpreters were supplied by the State Department.

Major iron ore companies of the United States cooperated fully and the group visited iron, taconite and jaspilite mines and beneficiation plants in Minnesota and Michigan. In Minnesota, the Morton pit of M. A. Hanna Company and Hull-Rust-Mahoning open pits, crushing and screening, and beneficiation plants were first visited, then Erie Mining Company's open-pit taconite mine and mill and on to Reserve Mining Company's Peter Mitchell taconite mine. Next, the group visited Oliver Iron

Mining Division, United States Steel Corporation's mines, crushing plants, beneficiation plants, sintering and nodulizing plant, and mine shops. The final Minnesota visit was to Reserve's Silver Bay mill.

At Duluth and Superior, the inspection group toured the ore railroad yards and iron ore loading docks to get the final look at the mining cycle. From Superior, they were driven to northern Michigan.

Technical inspections were made of Cleveland-Cliffs Iron Company's Michigan operations, including the Mather A and B underground mines and the research laboratory.

The final inspection trip was to Republic, Michigan where they visited the open-pit mine and flotation plant of Marquette Iron Mining Company. The iron source is a jaspilite or specular hematite at this operation.

Thus, the group saw the latest United States mines and mills with both open-pit and underground mining of a wide variety of ores. The full range of beneficiation was also seen—crushing and screening, washing, heavy media separation, cycloning, spiral concentration, magnetic concentration, flotation, nodulizing, pelletizing, and sintering.

Leading the Russian group of iron ore specialists was Mikhail Aleksandrovich Pokrovsky, chief specialist for the Iron Ore Industry, State Scientific

and Technical Committee (GNTK), Moscow. He is also deputy chairman of the Technical Committee, Council of Ministers, USSR. Management of the entire Russian steel industry rests with Gosplan and GNTK. The latter is responsible for the technology necessary to attain production goals for the industry as a whole or for a given mine or beneficiation plant.

Once a plan has been made and technology worked out for steel production for any new plants or expansions, it becomes the duty of the Regional Economic Council (SovNarkhoz) to carry out the program. The chairman of one of the fastest growing regions mineral-wise was a member of the delegation. He was Rashid Abdullovich Kadyrbaev, chairman, Kustanaiskiy SovNarkhoz, at Kustanay, Kazakhstan. He worked from the bottom up and after 24 years in mining became the chairman of one of Russia's 103 Economic Councils. These Councils control all industry within their regions. Vast expansion in ore output is planned in this district by 1965 under Mr. Kadyrbaev's direction.

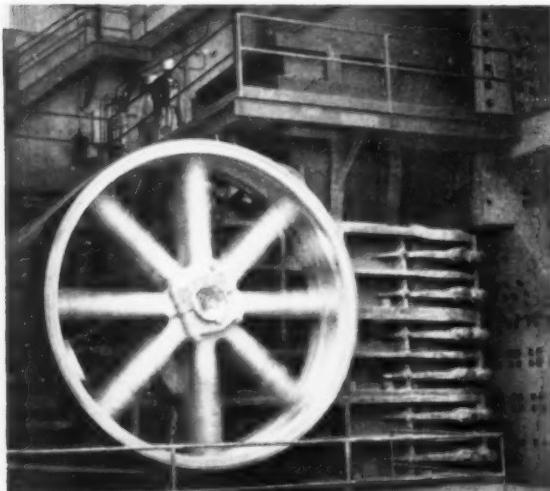
Russia's renowned Iron Mountain, Magnitogorsk, is mined by two major open pits. In charge of all mining and ore preparation at Magnitogorsk is group member Ivan Semenovich Sheetov, chief engineer for MMK.

From the Leningrad Mechanobr
Continued on page 90



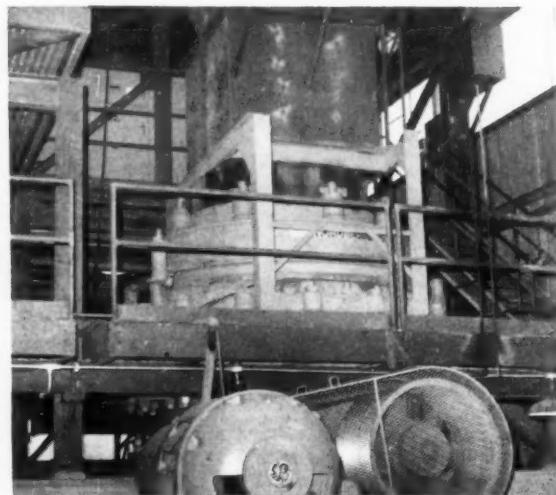
PIMA MINING COMPANY'S new mill has been in operation since January 1, 1957. Currently processing 3,400 tons of copper ore per day, the mill's heads average about 1.76 percent. Ore is received from Pima's nearby open pit (See July 1958 issue of *MINING WORLD*) and is hauled to the mill in Kenworth tractor trailers. Primary crusher building is shown at right, secondary in center, and concentrating section is shown at the left.

How the Pima Mining Company Mills

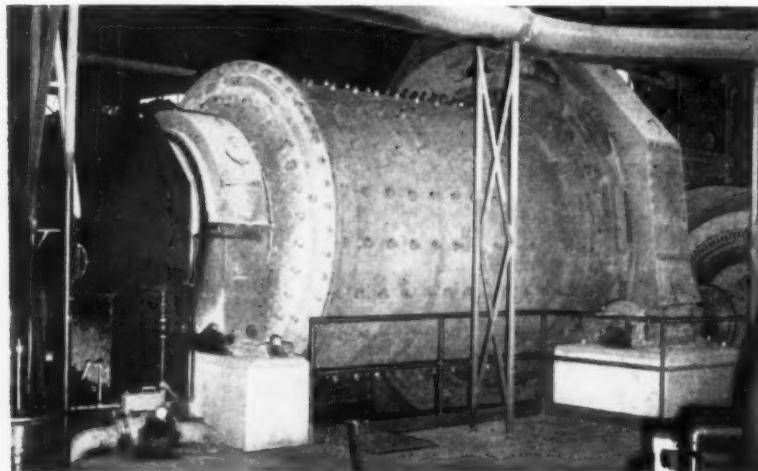


PRIMARY CRUSHING UNIT is housed in a building of its own. The primary crusher shown is a Birdsboro 66-inch by 84-inch jaw crusher, which crushes the copper ore to minus-7-inches.

The crusher is belt driven.



SYMONS CRUSHERS, a 7-foot standard and 7-foot shorthead, are in closed circuit with two double deck Tyler screens. Top deck oversize goes to the standard and the bottom deck oversize to the shorthead.

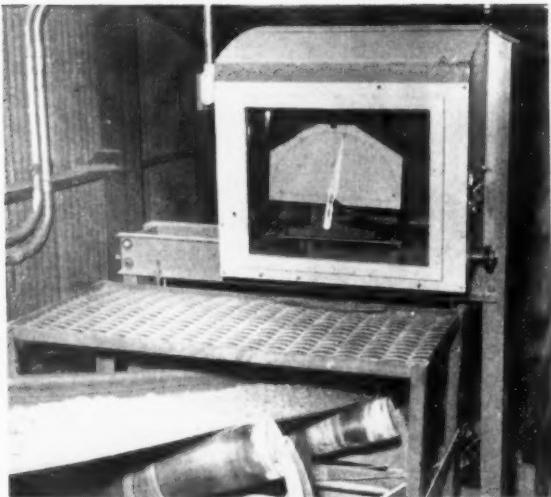


ALLIS-CHALMERS, 10- by 13-foot rod mill, operating in open circuit, receives ore from any combination of two of the four belt feeders, at a rate of 3,300 to 3,600 tons per day. The rod mill discharge is split between two primary cyclone feed sumps. One side uses a 10-inch Type T Amsco dredge pump, while a parallel unit is a Type CT Barrett-Haentjens solids handling pump, delivering the discharge at 50 to 57 percent solids.

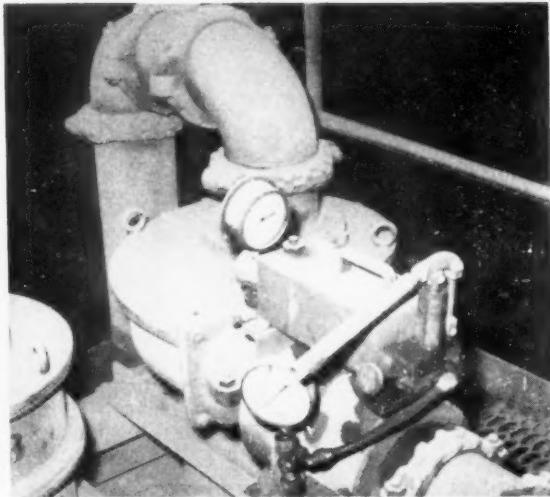
ROSS CHAIN FEEDER draws the run of mine ore from the chute into the primary crusher, located below. The ore is fed into the chute either by truck or dozer (stockpiled ore is fed by bulldozer). A full 50 ton truck-load of ore can be handled by the chute. Steel plates are on the chute bottom, thus extending the life of the structure. Four (three hourly plus a foreman) men operate the primary and secondary crushing sections.



Copper Ore from its New Arizona Pit



WEIGHTOMETER, integrated with feeders, provides a uniform flow to the rod mill. This feed, crushed to minus- $\frac{3}{8}$ -inch by secondary crushers, is being drawn out of two fine ore bins having a live capacity of 4,000 tons.



KREBS D-20-B CYCLONE with a five-inch Krebs hydraulic slurry valve attached. The valve can control the amount of feed entering the cyclone in case mill head feed should fluctuate. Cyclone inlet pressure is 8 to 10 pounds.

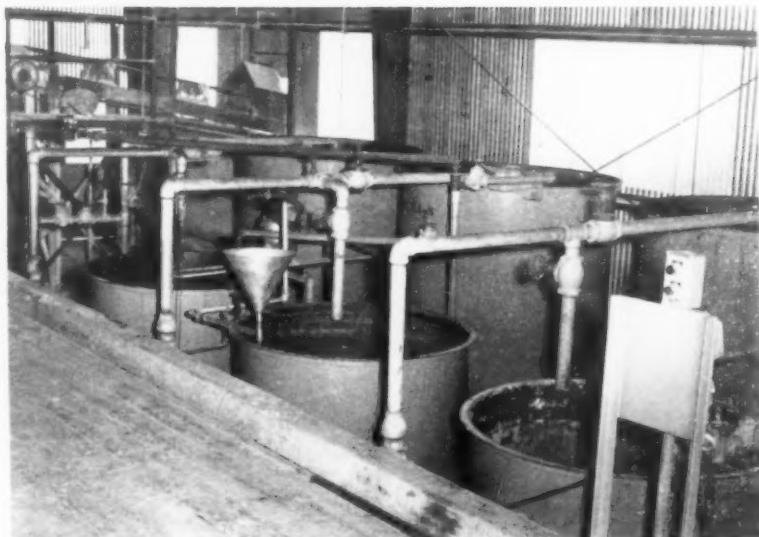
FAGERGREN FLOTATION MACHINES are being used as roughers at Pima. The flotation feed passes through a distributor, dividing the pulp to six parallel banks of 66-inch Fagergren roughers. Rougher concentrate from the first four to seven cells is sent to a 7-cell No. 24 Denver cleaner. Concentrate goes to a 3-cell No. 24 Denver recleaner unit. Cleaner tailing is combined with the scavenger concentrate produced on the last six cells of the rougher bank.





SMALL WILFLEY table is used to keep a visual check of the content of flotation tailing. Based on a flotation tailing assayed screen analysis, the calculated sulfide copper content of the tailing is 0.13 percent, while the oxide copper content in the tailing was 0.10, making the total 0.23 percent. The above figures hold for the first eight months of 1958 operation, and take into consideration 689,782 tons of tailing. During this time the mill feed was 735,903 tons, and copper concentrate was 46,121 tons. Assay of this mill feed and concentrate were 1.87 and 26.33 percent.

MILL REAGENTS are mixed on day shift and then pumped to day storage tanks. Lime, methyl isobutyl carbinol frother, Z-6 Xanthate are added to the rod mill. Z-6 and/or Z-11 xanthate and methyl isobutyl carbinol frother are added to the distributor, second, fourth, sixth and rougher flotation cells. Sodium sulfide, when needed is also added to the fourth, sixth and eighth cells. Average reagent consumption for the first eight months of 1958 in pounds per ton of ore milled is as follow: Lime—7.083; Frother—0.090; Xanthate—0.119; Sodium sulfide—0.369.



MIXING LIME for pH control in the Pima mill circuit. Pebble lime is purchased and is slacked in a Dorr lime slacker. Nearly all of the lime being added is used in the grinding circuit of the mill. A pH of 11.2 to 11.6 has been found to be the best for the ore currently being treated. The lime is mixed with fresh water pumped six miles from wells along the Santa Cruz River to a 50,000 gallon fresh water storage tank. This is the potable water supply as well as makeup water for the mill. The mill requires 240 gallons per ton of ore as makeup water.

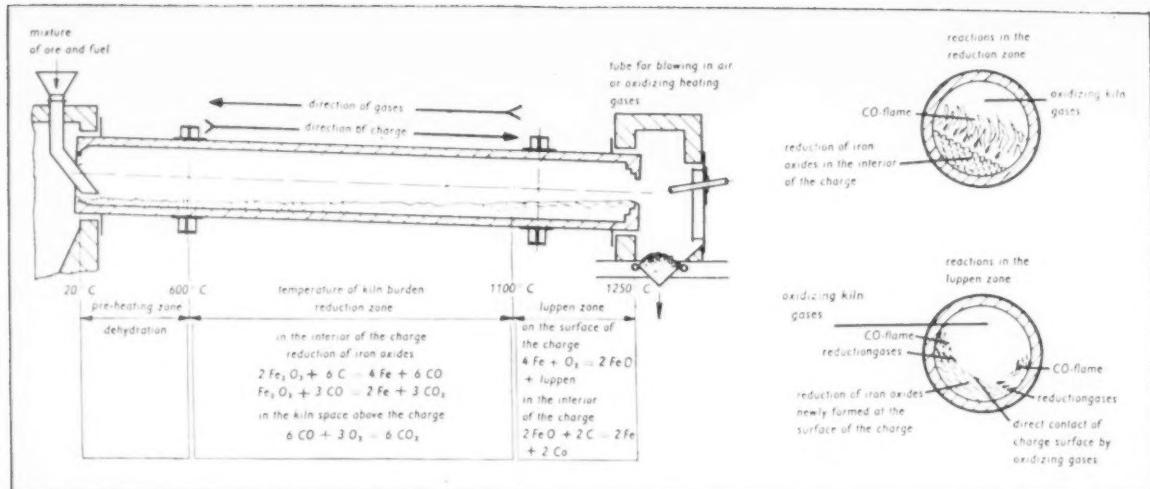
THIS EIMCO SEVEN DISC, six-foot filter receives the underflow of re-cleaner concentrate from a 50-foot diameter Dorr thickener. The overflow from the thickener returns to the middling sump for use as dilution water in the grinding circuit. I-R vacuum pumps provide the vacuum for the filters. Should the character of the ore change, a regrind circuit is available. It consists of a 7- by 12-foot Allis-Chalmers overflow ball mill operating in closed circuit with six 10-inch Krebs cyclones, with cyclone overflow used for dilution water in primary grinding circuit.



COPPER CONCENTRATE is conveyed to storage in the steel building shown in the picture. The building has a concrete floor, and the concentrate is moved from the building by a Joy slusher into 25-ton Kenworth dump trucks. Concentrate is weighed and sampled for moisture at the mill and then hauled seven miles to the railroad. After the car is loaded and leveled, it is pipe sampled in a grid pattern for copper analysis. Currently the concentrate is shipped to the copper smelter at Hayden, Arizona operated by American Smelting & Refining Company.

TAILING from the concentrator flows by gravity in thickened to slime disposal ponds about 6,000 feet from mill. The tailing is cycloned to obtain sand to build berms for the pond. Reclaimed water is passed through a decant tube and then to a gathering sump from which it is pumped to a 250,000 gallon water storage tank above the mill. Electric power for mill consumption is purchased from the Tucson Gas, Electric Light & Power Company and is delivered to the Pima substation at 44,000 volts, then stepped down to 4,160 for distribution.





ROTARY KILNS are the key to Krupp Renn direct reduction process. These kilns, burning low-grade fuels, operate at a temperature of 600 to 1,100° C. with carbon monoxide reducing

iron oxides to sponge iron. The sponge iron is nodulized within the pasty slag matrix in the luppen zone of the kiln. Nodules are separated magnetically.

What's New With Krupp Renn Process?

Iron-Nickel, Titaniferous Iron Ores, and Iron-Zinc Sinter Are Now Directly Reduced in Krupp Renn Kilns

It's no secret that the steel industry has long dreamed of a simple, workable process for direct reduction of iron ore. With the flurry of publicity in the past year or two regarding this subject, it might be well to pause and examine a method developed over 20 years ago by the German industrial concern, Fried. Krupp. Called the Krupp Renn process, it has probably enjoyed wider commercial application than any other direct reduction process. Today, it holds interesting speculative possibilities for use here in the United States.

Basically, the Krupp Renn process involves the continuous reduction of iron ore in a rotary kiln. The kiln discharges a product consisting of $\frac{1}{16}$ - to $1\frac{1}{2}$ -inch metallic nodules, the so-called "luppen", which are dispersed in the pasty slag. After cooling the kiln discharge can be crushed and magnetically separated into luppen and slag.

One estimate places the cost of producing a ton of luppen (92 to 95 percent iron) at \$18.25. At this cost the process begins to look more appealing, because, like other methods of direct reduction, the Krupp Renn process straddles both ore beneficiation and reduction of iron oxides.

Southwestern Engineering Company, Los Angeles, California, United States representatives for the Krupp Renn process, list other advantages. For instance, reduction is not dependent on the use of lumpy metallurgical coke. A low-quality, solid carbon fuel can be used to reduce the ore. A wide range of ores with varying physical characteristics can be treated. This includes both low-grade ore and fine ore. Kiln processing does not require agglomeration or pelletizing of the ore. The Krupp Renn process is amenable to high-silica ores.

Luppen, separated from slag, might, in some economic circumstances, be suitable for conversion directly to steel in an electric or open hearth furnace. The capital cost of a Renn plant would probably be less than half that required for a blast furnace facility including a sintering plant. The power consumption is low (estimated at 50 kilowatt-hours per ton of ore).

Other Reduction Processes

Krupp Renn treatment of iron ore, however, isn't offered as the only answer to direct reduction. Other methods are being studied which also look promising. Some provide advantages

that are not possible by kiln treatment.

Practically every steel producer in the United States is investigating a direct reduction method for iron ore. Most of the research and development work now underway involves treatment of the ore in a kiln, or in a fluidized bed, or in a shaft furnace. The Krupp Renn process and the R-N process, the latter a joint undertaking of National Lead Company and Republic Steel Company, are examples of kiln treatment. The much publicized H-iron process developed by Hydrocarbon Research Inc. is an example of the fluid bed method. Incidentally, Alan Wood Steel Company, last October, announced plans for installing an H-iron reactor in New Jersey capable of turning out 50 tons per day of powder iron from the ore. The Swedish Wiberg process is an example of direct reduction in a shaft furnace. The latter has been in use for some time in Sweden, but under our own economic system there is some question as to whether it would be profitable in the United States.

Every year the steel industry moves a little closer to the application of direct reduction methods. The next decade should witness construction of

plants here in the United States. This statement is based on the intensity and quality of research now prevailing, plus the trends of our times.

Why Direct Reduction?

One might logically ask—why all the interest in direct reduction of iron ore? The answer is simply a matter of costs and raw material supply. Scrap prices have been on the rise. And scrap forms a sizeable proportion of all the new steel poured from furnaces each year. Synthetic scrap produced by direct reduction could possibly become competitive if the present economic cycle continues. The synthetic scrap, so produced, would also have the advantage of not containing alloying elements, such as nickel, chromium, and others, which are normally present in natural scrap.

Another powerful reason for study of direct reduction is that the cost of building a blast furnace industrial complex has grown to staggering proportions today. The capital outlay for new pig iron capacity is tremendous. It is conceivable that expanded blast furnace capacity could possibly be obtained by enriching the charge with low quality iron from a direct reduction process. In other cases it may be possible to charge iron produced by direct reduction directly to steel furnaces.

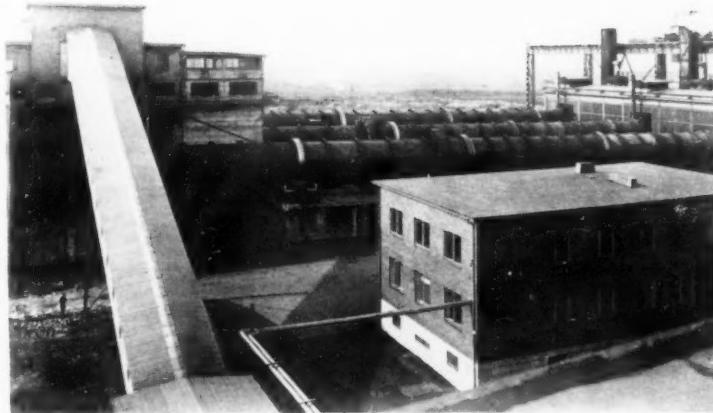
Blast furnacing is founded on the use of high quality coking coal and this presents a problem in some locations. In the United States, steel plants are located close to sources of coal suitable for producing metallurgical coke. Though we are blessed with large reserves of this coal, it is primarily located in the northeastern quadrant of the country. And our economy is growing both to the south and to the west of this section opening up new markets for steel. The supply of coking coal imposes severe limitations on plant location to serve these growing requirements for steel.

A broad, the problem is even worse. Many iron producing and consuming nations don't have resources of coking coals.

The above reasons help explain why there is a scramble to perfect direct reduction methods. The processes under study permit more flexibility in reductants, in some cases hydrogen, methane, or other gases are used. In other cases solid fuels lacking the rigid specifications for coking purposes are suitable. Some processes also provide more flexibility in the ore that can be treated.

Will direct reduction of iron ore ever become competitive to the blast furnace? It is entirely possible that

These K-R Plants Treat Unusual Ores



KRUPP RENN PROCESS was developed in Germany in the 1930's and most of plants have been built there. This is a typical installation showing the long kilns and the auxiliary facilities.

In 1945 a total of 38 Krupp Renn kilns had been placed in service in Germany, Japan, Manchuria, and Korea. Most of these installations, however, were dismantled immediately following World War II and activities of the Fried. Krupp concern were greatly restricted during the early part of the reconstruction period. These restrictions were relaxed in 1950, and the giant firm is again in a position to engineer and construct plants. In the meantime, several new Krupp Renn processing plants were put into operation or are in various stages of planning. Data regarding the size and feed to these plants is included in Table No. VIII. A few brief remarks concerning the recent plants are included below.

Spain was confronted with a problem of growing demand for iron, sources of high silica ore, and a lack of metallurgical coke following World War II. As a result of investigations, Messrs. Siderurgica Asturiana S. A. established a Renn plant at Aviles, which was originally equipped with one kiln. After the first kiln was in satisfactory operation in 1954, a second unit was ordered.

A single Renn kiln was installed in Greece in 1956 for converting nickeliferous ore into an iron-nickel alloy. This plant was operated under Messrs. Societe Anonyme Hellenique de Produits & Engrais Chimiques.

The reconstruction of a Renn plant at Salzgitter-Watenstedt, West Germany, in 1956, resulted in increasing pig iron production without increasing the blast furnace capacity of a German combine of eight large iron and steel plants in the Ruhr district. The Salzgitter-Watenstedt plant is treating a low-grade, high silica, phosphorus-bearing middlings from ore preparation plants of the Salzgitter district by the Krupp Renn process. The resulting high phosphorus luppen is then treated in Ruhr blast furnaces of the above combine. High grade concentrates of the Salzgitter district are also treated in the blast furnaces. But prior to reconstruction of the Renn plan, both middlings and concentrates from Salzgitter-Watenstedt ore dressing plants were mixed and charged to the Ruhr blast furnaces with a resultant lower iron content than is now possible. Three kilns were put into service in this project in 1956 and construction of a fourth is projected.

Construction is now underway for another Renn plant in the Ruhr district to be operated as a joint venture by a group of nine industrial iron and steel producers in the area. This plant is to be erected at Essen-Borbeck and will produce phosphorus luppen as well as luppen free of phosphorus. The luppen will then be treated directly in either electric furnaces, in OH furnaces of the above group, or else in blast furnaces. This latest, planned plant is expected to relieve a strained condition due to a shortage of scrap, which now exists in the area. In addition the quality of the luppen will be far superior to available scrap, since it will not contain alloy constituents normally found in scrap. The Essen-Borbeck plant is planned to accommodate six kilns.

A Renn-Waelz plant at Sturzelberg is recovering zinc oxide (in the flue dust) and iron luppen from a feed consisting of calcined pyrite. The roasted calcine contains 10 percent Zn and 44 percent Fe. One kiln has been installed for the producer, Messrs. Sachtleben A. G.

These Calculations Prove Why Krupp Renn

Table No. I

Assumed Data for Calculations Based on Estimate and Actual Operating Experience

Basic Variable Data	
Luppen production	
% Fe in product	$\times \frac{100}{\% \text{ Fe in ore}} = \frac{\text{No. tons ore}}{\text{Ton luppen}}$
95%	$\times \frac{100}{50\%} = 2 \text{ tons ore per ton luppen}$
Cost per ton of ore at mines	\$ 1.00
Cost per ton of flux at source	\$ 2.00
Freight per ton on flux source to site	\$ 1.00
Cost per ton of coal at mine	\$ 3.00
Freight per ton of coal-mine to site	\$ 2.00
Cost per ton of coke breeze at source	\$ 5.00
Freight per ton of coke-source to site	\$ 2.00
Cost of water at site—cents per 1,000 gallons	\$ 0.01 per 1,000 gallons
Cost of electric power at site—cents per kWh	\$ 0.01/kWh
Cost of labor-hourly rate	\$ 2.30
Amount of fuel for reduction expressed in percent per ton ore	37%
Amount of fuel for heating expressed in percent per ton ore	8%
Amount of flux required expressed in percent per ton ore	10%
Electric power consumption— per ton of ore	50 kWh
Heating kiln-coal requirements per hour per kiln	2.33 tons
Maintenance & repair— per year on investment	4%
Kiln lining cost per year	\$171,550
Slag disposal—per ton of product	\$0.02
Water consumption for quenching and cooling— gallons per ton product	320
Fringe benefits of labor—12% of labor wage	
Supervision & salaries—20% of labor	
Force—139 men (2,100 ton plant)	
Operating time—325 per year working days	
Man hours—202,800 per year (2,100 ton plant)	
Interest—5% per year on $\frac{1}{2}$ investment	
Amortization—5% per year on investment	

Table No. III

Estimated Processing Cost Per Short Ton of Luppen

Plant Size	3 kilns of 15-foot diameter by 360-foot long
Investment cost	\$15,000,000
Production of luppen per year	291,000 tons
Ore throughput per day and per kiln	596 tons
Total throughput per day and per kiln	919 tons
Power 50 kWh/ton dry ore (Table I)	
2 tons ore/tон luppen \times 50 kWh \times \$0.01 = 1.00 per ton luppen	
Heating of kiln 10° hr. \times 720° after relining	
2.33 t. coal/hr \times \$5.00/ton coal \times 3 kilns \times 1½ times/yr.	
$10^{\frac{1}{2}}$	
291,000 tons luppen	$\equiv 0.01/\text{ton}$
Maintenance & repair per ton luppen	
4% \times 15,000,000 (Table I)	\$2.06
100 \times 291,000	
Kiln lining per ton luppen	
171,550 t. luppen (Table V)	\$0.50
291,000	
Slag disposal per ton luppen	
This covers movement to and disposal on slag pile	\$0.02
Water—320 gals/ton luppen for quenching and cooling (Table I) 320 gal. x 0.01 per 1,000 gal.	\$0.01
Wages—(See Tables Nos. IV and V)	
74 shifts \times 8 hrs. \times 325 days = 192,400 man hrs.	
192,400 man hrs. $\equiv 0.7$ man hrs./ton luppen	
291,000 tons luppen	
\$509,233 oper. labor cost = \$2.65 cost/man hour	
192,400 man hours $\times 0.7 \times \$2.65$	\$1.86
Overhead—This is equal to 20% of the basic wage rate.	
\$1.86 \times 0.20	\$0.37
OPERATING COSTS PER TON LU彭EN	\$5.83

Table No. II

Raw Material Costs Per Short Ton of Luppen

Iron ore needs	
Assume Fe in ore = 50%; recovery 95% product Fe 95%	
Two tons of ore yield 0.95 ton metallic iron in 1 ton product (luppen)	
Cost per ton of ore	\$1.00
Cost per ton of luppen (2 tons ore/ton luppen \times 1.00)	\$2.00
Flux needs	
Lime—10% per ton ore (Table I)	
Cost—\$2.00 + \$1.00 freight	\$3.00 per ton
Cost per ton of ore 10% \times \$3.00 100	\$0.30
Cost per ton of luppen 2 \times \$0.30	\$0.60
Coal needs	
Reduction coke 37% (Table I) 2 \times 37%	64¢ per ton luppen
Heating coal 8% (Table I) 2 \times 8%	16¢ per ton luppen
Cost: coke \$5.00 \$2.00 (Table I) coal \$3.00 \$2.00 (Table I)	\$7.00
Cost of coke per ton ore 37% \times 7.00 100	\$2.59
Cost of coke per ton luppen 2 \times 37% \times 7.00 100	\$5.18
Cost of coal per ton luppen 2 \times 8% \times \$5.00 100	\$0.80
Total raw material costs per ton luppen	
Ore	\$2.00
Fluxes	\$0.60
Fuel, coke	\$7.18
Coal	\$0.80
TOTAL RAW MATERIAL COSTS PER TON LU彭EN	\$8.58

Table No. IV

**Estimated Force Requirement
Krupp Renn Process For Iron Production
Using Three Rotary Kilns**

Occupation	Per Shift	Per Day	Hourly (or Monthly) Rate	Cost Per Day
	1	2	3	4
General				
General—Foreman	0-1-0	1	900	29.60
Asst. Genl. Foreman	1-1-1	3	800	78.95
Chief Clerk	0-1-0	1	650	21.58
Clerks	0-1-1	2	2,150	34.88
Chemical Analyst	0-1-0	1	650	21.58
Sampleman	1-1-1	3	2,215	54.36
Warehouseman	0-1-0	1	2,280	18.24
Janitor	0-1-0	1	2,190	15.12
Total	2-8-3	13		273.91
Storage yard & crusher				
Foreman—Turn	0-1-1	2	650	42.76
Crusher Operator	0-1-1	2	345	38.00
Coal Pulverizer Oper.	0-1-1	2	150	14.88
Craneman	0-1-1	2	2,280	36.96
Yardman	0-1-1	2	2,085	33.84
Conveyorman	0-1-1	2	2,085	33.84
Greaser	0-1-1	2	2,085	33.84
Total	0-7-7	14		254.12
Kilns				
Foreman—Turn	1-1-1	3	700	60.08
Kiln Operator	2-2-2	6	2,475	121.20
Kiln Operator helper	2-2-2	6	2,215	108.72
Feeder Attendant	2-2-2	6	2,150	105.60
Fuel Coal Fan Tender	2-2-2	6	2,150	105.60
Conveyorman	1-1-1	3	2,085	51.24
Greaser	1-1-1	3	2,085	51.24
Total	11-11-11	33		612.68
Milling & separation				
Foreman—Turn	0-1-1	2	650	42.76
Milling Plant Oper.	0-1-1	2	345	38.00
Magnetic Sep. Oper.	0-1-1	2	345	38.00
Craneman	0-1-1	2	2,280	36.96
Car Loader	0-1-1	2	2,150	34.88
Conveyorman	0-1-1	2	2,085	33.84
Greaser	0-1-1	2	2,085	33.84
Total	0-7-7	14		258.28

Continued on next page

Makes Direct Ore Reductions Competitive

Maintenance	Kiln	Reline		
Foreman-maintenance	1-1-1	3	650	64.14
Foreman-burn				
Welder-crushers		3		
Repairman-crushers	1-1-1	3	2,670	65.28
Repairman-kilns	1-1-1	3	2,670	65.28
Repairman-electrical				
Bricklayer	1-2-1	4	2,605	84.56
Carpenter				
Machinist-repair shop				
Welder-repair shop	1-2-1	4	1,890	61.28
Laborer				
Total		17		340.94

Table No. V
Operating Labor Cost And Cost Of Relineing

General	\$ 273.91
Storage Yard & Crusher	254.12
Kilns	612.68
Milling & Separation	258.28
	<hr/>
\$1,398.99 x .325 days = \$454,672/year	
\$454,672 + 12% fringe benefits = total cost/year	\$509,213
RELINING KILNS	
Material cost	
Reline 2/3 of kiln each 30 months	
2 1/3 length = 5 2 years = 0.266 length/year	
Reline remaining 1/3 of kiln each 8 months	
1 1/3 length = 2 2/3 years = 0.5 length/year	
Total reline required/year = 0.766 length/year	
Brick cost per kiln = \$42,113	
Brick cost per year = 3 kilns x \$42,113 x .766 = \$96,858/year 56.5%	
Labor cost	
Reline labor = \$340.94/day (Table IV)	
(\$340.94 + 12% fringe benefits plus 20% overhead) x 163 days =	
\$74,692/year 43.5%	
TOTAL COST PER YEAR	\$171,550 100.0%

Table No. VI
Estimated Capital Costs
Of 3-Kiln Krupp Renn Plant

The interest rate is based on 5% of the unamortized amount or $\frac{1}{2}$ of 5% of the total investment over the total period.)	
Investment cost (\$15,000,000)	Cost per ton luppen
5% x \$15,000,000 tons luppen	\$2.58
100 291,000	
Interest	
5% on $\frac{1}{2}$ investment	
$\frac{1}{2} \times 5\% \times 15,000,000$	
100 291,000	1.29
TOTAL CAPITAL COSTS per ton luppen	\$3.87

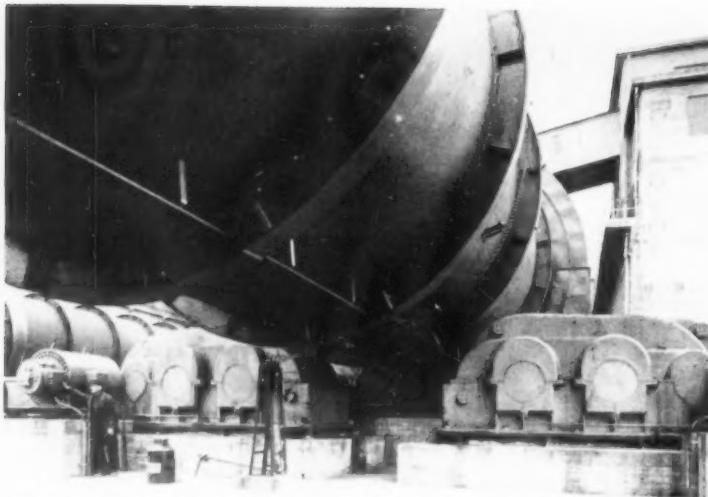
Table No. VII
Total Estimated Cost Per Ton Of Luppen
Treated In Krupp Renn Plant

Plant size	3 kilns of 15 x 360 feet
Investment cost	\$15,000,000
Raw material	\$8.58 (From Table II)
Operating costs	\$5.83 (From Table III)
U. S. Manpower use (probable)	
Capital costs	\$3.87 (From Table VI)
TOTAL COST PER SHORT TON OF LU彭EN (U. S. MANPOWER USE)	\$18.28

Table No. VIII
Details of Krupp Renn Plants in Spain, Greece, and West Germany
and the Chemical Analysis of Ore, Fuel, Slag, and Luppen at These Plants

AVILES, SPAIN	LARYMNA, GREECE	SALZGITTER- RUHR AT SALZGITTER- WATENSTEDT	ESSEN- BORBECK, WEST GERMANY (Under construction)	RENN-WAELZ PLANT AT STURZELBERG, GERMANY (Large-scale pilot plant)
ORE				
33 to 45% Fe	1.4 to 1.8% Ni	(Product of wet ore dressing plant, ore mined Salzgitter A.G.)		
21 to 40% SiO ₂	25.2 to 36.5% Fe	33 to 35% Fe		
5 to 7% Al ₂ O ₃	15.5 to 33.3% SiO ₂	19 to 22% SiO ₂		
0.1 to 0.3% MgO	11.4 to 14.5% Al ₂ O ₃	14 to 15% Moisture		
1.8 to 2.7% CaO	2.4 to 2.9% CaO	Ore middlings of the wet ore dressing plant (Bar- bara Erzbergbau A.G.)		
0.5 to 0.8% P	2.1 to 2.8% MgO	31 to 33% Fe		
0.02 to 0.08% S		24 to 26% SiO ₂		
		14 to 15% Moisture		
FUEL	Anthracite fines 20% H ₂ O; 20% ash and 3 to 7% volatile matter.	Coke breeze and anthra- cite.	Coke breeze.	Coke breeze.
PLANT Size	One kiln, 3.6 meters diam- eter and 60 meters long; throughput 300 tons ore and fluxes per day; output 90 tons luppen per day.	One kiln, 4.2 meters diam- eter and 90 meters long; throughput 400 tons of ore per day.	Two kilns, 4.2 meters diameter and 95 meters long; 1 kiln 4.6 meters diameter and 110 meters long; throughput 2,000 tons ore per day; output 610 to 780 tons luppen per day.	Six kilns, 4.6 meters diameter and 110 meters long; construction started in 1958; ex- pected output 400,000 to 450,000 TPY.
LUPPEN COMPOSITION	54.5% SiO ₂ 12.0% Al ₂ O ₃ 17.0% CaO 1.5% MgO 5.0% volatile matter.	90% Fe 4% Ni 1.9% Cr 0.3% S ¹	92 to 94% Fe 0.6% C 1% P 0.75% S	
			2 to 4% adhering slag.	
SLAG COMPOSITION	0.8 to 1.2% C 0.6 to 1.0% P 0.3 to 0.4% S 91 to 94% Fe 3 to 5% adhering slag.		50% SiO ₂ 19.6% Al ₂ O ₃ 11.8% CaO 5.8% Mg 2.2% Fe 3.5% C	

¹ Luppen is remelted in electric furnaces and blown in oxygen converter; increases nickel content to about 9 percent



DRIVE for 110-meter long kiln in Salzgitter Ruhr plant is shown. This kiln measures 4.6 meters in diameter, and treats a low-grade, high-silica feed.

one or more of the many methods now being studied will find application in future expansion of the steel industry. No one, however, is going to junk the tried and tested blast furnace in favor of direct reduction. Direct reduction might be used in new construction for added capacity; it might be used to produce a substitute for scrap charged to open hearth furnaces; it might be used to enrich a normal blast furnace charge with resulting economies; and it might be used in areas where availability of flux and fuel is a problem. But direct reduction will not replace the blast furnace. It will only supplement or compliment present methods for making steel.

First Kiln in 1935

The Krupp Renn process was developed by Dr. Ing F. Johannsen between 1931 and 1939 in the pilot plants of Fried. Krupp in Magdeburg and Borbeck, Germany. It was the logical outgrowth of the Waelz process by which lead, zinc, and tin are volatilized out of their ores in a rotary kiln with subsequent recovery of the metals in the form of oxides. As was to be expected, Fried. Krupp put the first commercial size kilns in operation using the Krupp Renn method. These were installed in 1935. One kiln treated a high-silica ore and the other treated a garnierite containing 10 to 15 percent iron and 0.6 to 1.0 percent nickel.

At the end of World War II, 38 kilns having an annual capacity of 1,000,000 tons of luppen were in service in Europe and the Far East. Though most were dismantled as an

aftermath of the war (since most were controlled by German and Japanese interests), many new installations have started since 1950. These include plants in Spain, Greece, and Germany with a total of 15 kilns which either have been or will be installed. See the examples of operating practice included with the article.

Through the cooperation of Southwestern Engineering Company, a brief description of the physics and chemistry of the process is presented with this article.

How it Works

Direct reduction by the Krupp Renn process is carried out at a temperature below the melting point of the charge. The kiln is charged with ore, a solid fuel and a flux, if necessary, which have been crushed to $\frac{1}{8}$ -inch size. Carbon monoxide released from the solid fuel in the charge reduces the ore as the charge travels through the kiln to discharge. Heat for the reactions is furnished by a set of burners which operate intermittently at the discharge end of the kiln.

All of the various charge ingredients are weighed and partially blended by being layered on conveyor belts, or, if required, in special mixing plants.

In addition to ore, fuel, and flux, the charge to the kiln, in actual practice, will also contain return flue dust and a magnetic middling. The middling amounts to about 5 to 8 percent of the total feed and contains 65 to 70 percent iron. It is recovered during magnetic separation of the luppen and slag discharged from the kiln. The middling serves to seed the nodulizing

action which occurs in the final 20 percent of the kiln length by serving as nuclei for sponge iron agglomeration.

One of the chief advantages of the Krupp Renn process lies in the fact that fuels such as coke breeze, anthracite fines, charcoal, or low temperature coke can be used as the reductant in the charge. A coarse-sized fuel is not required for the charge. A fuel charged as fines does not present a critical operational factor, nor does the ash content of the fuel. The reductant should be crushed to $\frac{1}{8}$ -inch, however, since a coarser product will probably result in unburned carbon in the discharge of the kiln. A low-volatile fuel is more desirable for use as a reductant, because the volatile gases released during combustion are not utilized in the kiln and may cause either afterburning in the dust-collecting chamber or precipitation of tars. The fixed carbon content of the charge to the kiln approximates 18 to 22 percent of the total feed.

The burners at the discharge end of the kiln are generally fired with powdered coal; however, they can also be fired with oil. They serve as temperature control.

Three Zones in Kiln

The various reactions taking place in the kiln are outlined in accompanying flowsheet drawing. The charge travels through the kiln countercurrent to the gases, and, in so doing, passes through three zones. In the first zone the charge is dried and preheated to a temperature of approximately 600° C. Depending upon the manner of kiln operation, the preheating zone accounts for about 20 percent of the kiln length.

Reduction takes place in the middle 60 percent of the kiln length. In this zone the temperature ranges from 600 to $1,000^{\circ}$ C. and iron oxides are reduced to sponge iron by carbon monoxide which rises through the charge. Kiln design and proper operation provides that reduction always begins at that point of the kiln where free oxygen is still present. If the air supply through the kiln is diminished, this point moves toward the discharge end. If the air supply is increased, it moves to the feed end of the kiln. The sponge iron formed by the reduction reactions remains finely disseminated in the charge until the charge reaches the nodulizing or luppen zone.

The continual formation of carbon monoxide in the reduction zone results in a protective envelope of this gas over the surface of the charge. Thus the charge is protected from the free oxygen present in the kiln gases.

The carbon monoxide is burned to carbon dioxide above the tumbling mixture in the kiln.

At the temperature of reaction (600 to 1,000° C.) iron silicates are reducible. This presents the possibility of using iron resources not considered heretofore.

Nodulizing takes place in the final 20 percent of the kiln length. The discharge end is fitted with a raised brick ring. The purpose of the ring is to accumulate the charge in the final 20 percent of the kiln for several hours. Higher temperatures prevailing at this end of the kiln result in the formation of a pasty slag. Nodulizing of the finely disseminated sponge iron takes place within the protective coating of this pasty slag. Whereas the charge passes through the pre-heating and reduction zone in a relatively short period, it remains in the luppen zone for some hours.

At the head of the so-called nodulizing or luppen zone of the kiln, the reduction process is near completion and only small amounts of carbon monoxide are released from the charge. The air and heating gases blown in from the discharge end of the kiln make direct contact with the surface of the kiln charge since the protective envelope of carbon monoxide is lacking. This causes rapid surface combustion of the sponge iron in the oxidizing atmosphere, with a net rise in temperature in the luppen zone. The slag, becoming pasty, segregates out, leaving a skeleton structure of sponge iron in the charge. The constant tumbling at a temperature of 1,200 to 1,300° C. promotes extrusion of the slag. It also promotes mechanical kneading of the sponge iron and welding to form the luppen or iron nodules.

Any iron at the surface of the charge in the luppen zone which has acquired an oxide coating is worked back into the center of the charge during the tumbling action. Here it is again reduced by small amounts of unburned carbon remaining in the charge. Through proper control, at the most 3 to 4 percent of the iron is oxidized. The nodules formed in the kiln range in size from 1/16 to 1 $\frac{1}{2}$ inches in diameter.

Separate Luppen From Slag

The luppen and slag discharged from the kiln are water quenched. The material is selectively crushed to release the more friable slag. Conveyors deliver the mixture to a magnetic separator where the iron nodules are separated from the slag. The middling product recovered during magnetic separation is returned to the kiln

feed as previously mentioned.

In order to facilitate a good nodulizing environment, close control of the temperature and slag must be maintained in the luppen zone of the kiln. High silica slags (50 to 65 percent SiO₂) are preferable since they are naturally more viscous. The lime content of a normal Krupp Renn slag amounts to about 15 to 25 percent. This latter figure is much lower than prevails in a blast furnace, so the fluxing requirements of the process are less than that required for blast furnace feed.

For most iron ores only a small quantity of flux is required for the charge, since the ore usually contains a siliceous gangue. In the case of titaniferous ore, TiO₂ can successfully substitute for a portion of the silica yielding a titanium-enriched slag.

In practice, recovery of iron in the nodules has ranged from 90 to 96 percent. Through proper operation loss of iron to the slag can be maintained to only 3 or 4 percent. At some operations dust production has amounted to 10 percent of the charge, but fines can be recirculated with the feed.

The kiln makes effective use of both the latent heat and the sensible heat of the gases. The carbon monoxide originating from the charge in the reduction zone burns in the atmosphere above the charge. The heat developed by this combustion is taken up by the kiln lining and transferred back to the charge as the kiln rotates. The sensible heat of the gases is used for preheating the load in the kiln. The waste gases normally leave the kiln at less than 400° C. and contain little unburned carbon monoxide.

Sulphur—A Problem

One disadvantage of the Krupp Renn process is that, owing to the working with an acid slag, 30 percent of the sulphur contained in the charge reports in the luppen discharged from the kiln. This difficulty is not critical, however. One recourse is to use low sulphur fuels and ore. If this is not feasible, then the luppen must be desulphurized for the production of steel. If steel is made in an electric furnace, de-sulphurization can readily be accomplished with little difficulty. If an open hearth process is used, then sulphur can be removed by changing the slag which would involve additional expense, or else by applying new sulphurization processes before using the open hearth process.

In Japan, prior to World War II, difficulty was experienced with excessive erosion of the kiln lining, which reduced available operating

time. In other operations high fuel costs resulted from poor heat transfer. Control of slag fluidity during nodulizing is admittedly a critical point of the operation. These factors and the sulphur problem have probably combined to handicap universal acceptance of the process. But it should be added that most of these difficulties were reported before World War II. Since that time we have witnessed remarkable strides in equipment development, better refractories, and insulation. The chemistry and physics of the process have been well outlined, and suitable construction materials could eliminate many of the mechanical troubles.

The Krupp Renn process has the advantage of broad flexibility in the range of ores that can be treated. Low-grade ore can be processed. Fine ores can be treated, particularly those with a high silica content. Middling from ore dressing plants can be handled. Roasted pyrite can be reduced by this rotary kiln process. Titaniferous iron ores can be smelted in the kiln with production of iron nodules and a titanium-rich slag. The process shows considerable promise for nickeliferous ores. For instance garnierite has been treated with the formation of an iron luppen rich in nickel. Flue dust recovered from the kiln can be returned for treatment.

Similar treatment of iron-bearing ores which also contain zinc, lead, or tin could be used to recover more than one metal. The Renn-Waelz treatment of these ores could recover iron in the luppen. The metal vapors coming from the charge could be precipitated after being re-oxidized and recovered in a fine-dust of highly concentrated form.

The sample calculations included with this report were developed by Southwestern Engineering Company to show the anticipated cost of producing luppen in a plant built in the United States. They were based on an educated estimate of several variable factors shown in Table No. I. Some of the basic fixed data, also shown in this table, was determined from actual operating experience abroad, and was then translated to the United States equivalent. In any event these calculations serve only as a rough guide to expected costs, but any variation in assumed data that exists locally can be worked into the calculations to give the final cost-per-ton of producing luppen.

Also included with this report are several examples of plants abroad which are known to be in operation or under construction.

THE END



CATERPILLAR's side dumper



EUCLID's New R-27 rear dump



UNIMOG, go anywhere power



JOY's rotary percussion drill



MICHIGAN'S 110 reardump



WILD coincidence rangefinder



YOUR PICTURE by Bucyrus-Erie



R. G. LETOURNEAU'S new giant

San Francisco Exposition

New Equipment Shown; Import Quota Set

The Administration made import quotas on lead and zinc official as the American Mining Congress opened its Metal Mining Exposition in San Francisco, California on September 22. It was no surprise to most of those at the opening session when Interior Secretary Seaton announced that President Eisenhower had issued a Proclamation agreeing with the unanimous findings of the Tariff Commission on lead and zinc. Therefore, imports of lead and zinc were to be cut 20 percent from average 1953-1957 import level. A series of quotas were spelled out by countries shipping to the United States. See "Capitol Concentrates," page 9, for full details.

Reaction to the announcement was mixed. Many operators would have preferred tariffs; others thought that the quotas weren't high enough; and still others thought that quotas on concentrates would work severe hard-

ship on custom smelters. When the convention ended on the 25th, the majority had decided that quotas soon would raise the prices of lead and zinc and that it would be possible for major custom smelters to live under the quotas.

Record Machinery Exhibit

The new Brooks Hall (underground), as well as the Civic Center Hall, and outdoor exhibit area, were filled with exhibits from 180 manufacturers displaying all types of mineral industries equipment ranging in size from diamond dust to the world's largest self powered scraper.

And it looked like many of the manufacturers had kept their newest equipment under wraps until the Exposition, as many new and improved machines were announced and exhibited for the first time. There is no

question but that the use of this new equipment will go a long way in cutting costs. Pictures of much of this new equipment are shown on three pages of this report. It was apparent that the annual MINING WORLD Blue Ribbon awards for outstanding equipment developments have great prestige in the industry. The Blue Ribbon certificates formed a prominent section of numerous exhibits.

Autogenous Grinding

Harlowe Hardinge, president Hardinge Company, Inc., reported that autogenous grinding today was where stage grinding in closed circuit with sizing devices was in the early 1900's. But the technique, or "art" as he called it, is advancing rapidly. Most important for its application is location of the property, other local conditions, and the character of the mate-



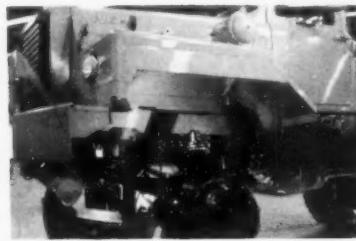
HARNISCHFEGER shows Magnetorque controls



LeTourneau-WESTINGHOUSE'S new Hydrair truck



INGERSOLL-RAND's Vacujet



MACK has new 6-wheel drive



GISO now rubber tired



CLARKSON valve for slurries



ALLIS-CHALMERS' compactor

rial to be ground.

Control engineering divides into two classes, according to Carl M. Marquardt, Industrial Physics and Electronics Company, Salt Lake City, Utah. These classes are: process control to obtain better economic results by use of pH, density, and other controls; and "industrial gadgetry," such as, automatic pumping, bin level indicators, etc. The second type offers greatest field for expansion, he said.

Open Pit, Underground Mining

The larger the blast the better the fragmentation for taconite, reported Floyd W. Erickson, manager, Babbitt Division, Reserve Mining Company, Babbitt, Minnesota. Over 50 percent of the tough hard taconite is minus- $\frac{3}{4}$ -inches after a large blast. This means much greater life for shovel buckets and teeth, and crusher concaves and mantles.

P. M. Lindstrom, superintendent

Radon mine, and W. H. Love, manager of mines, Hecla Mining Company reported that caving long wall stoping using yieldable steel props resulted in controlled caving of hanging wall after complete extraction of the flat-lying high-grade uranium ore. This is first United States metal mine to use this method of stoping.

Preventive maintenance, regular and complete inspection of Diesel equipment every 25 hours, and care of underground roadways has cut costs for mechanized off-track equipment at American Zinc Company of Tennessee's mines, according to Harry L. Miller, superintendent of the firm's Jefferson County operations. One man working on roads takes the place of two mechanics, he emphasized.

Cartridged, prilled ammonium nitrate looks very promising for cutting ore breaking costs in the Tri State zinc-lead mines of the Eagle-Picher Company, stated Joseph B. Elizondo, superintendent of mines.

AMC President Young Retires

AMC president Howard I. Young, president, American Zinc, Lead and Smelting Company announced that he was retiring as president of the American Mining Congress after serving the industry for 25 years. No successor has been named.

Joubin Speaks on Uranium

One of the convention highlights was the meeting of the Uranium Institute of America where Francis Joubin, discoverer of Canada's Blind River uranium deposits, spoke. He asked why uranium producers had such a fear phobia. He doesn't know and pointed out that uranium's future was more important than any other metal because it is a fuel to produce power, and power is civilization. Cost of all other fuels will go up but uranium cost will come down, he predicted.



URANIUM HIGHLIGHTS were discussed by D. W. Viles, Vanadium Corporation of America; Albert V. Quine, Lucky Mc Uranium Corporation; Neill K. Banks, Texas-Zinc Minerals Corporation; Ray Jenkins, Phillips Petroleum Company, and Richard J. Stoehr, Homestake New Mexico Partners.

National Minerals Policy

The sessions on National Mineral Policies were extremely well attended for the current plight of the domestic mining industry was the keynote of each speaker's address. The Honorable Thomas C. Mann, Assistant Secretary for Economic Affairs, Department of State, presented the U.S. long-range view. He reported that the U.S. has agreed to take part in a proposed international study of ways to reduce the boom and bust cycles in the lead and zinc industries, and endorsed President Eisenhower's decision to impose import quotas on lead and zinc rather than raise tariffs. He said that quotas are "a sign of our intention to seek multi-lateral solutions."

The domestic industry views were well represented. Charles E. Schwab, Assistant to the President of Bunker Hill Company, and chairman of the Emergency Lead-Zinc Committee, got the ball rolling by pointing out that the status of his industry was an outstanding escape clause case and other

Salmon Derby Winner



J. HALL CARPENTER, Carpeo Research and Engineering, poses for MINING WORLD with \$100.00 gold prize for catching largest Pacific salmon.

Brunton Winners

WORLD MINING COVERAGE OF MINING

W. P. Nichols Wins Brunton

Each day of the convention MINING WORLD held a drawing to determine the lucky winner of a Brunton compass. Winners were: W. P. Nichols, White Pine Copper Company, White Pine, Michigan; J. T. Elmer, Kaiser Aluminum & Chemical Company, Oakland, California; Hugh M. Craigie, Sabre-Pinon Corporation, Santa Fe, New Mexico; and Charles W. Sweetwood, J. R. Simplot Company, Boise, Idaho.



METALS TODAY was the report of this group. From left: Frank Coolbaugh, American Metal Climax, Inc.; Simon Strauss, American Smelting and Refining Company; Mitchell Kline, Rare Metals Corporation of America; Spencer Hutchinson, Atomic



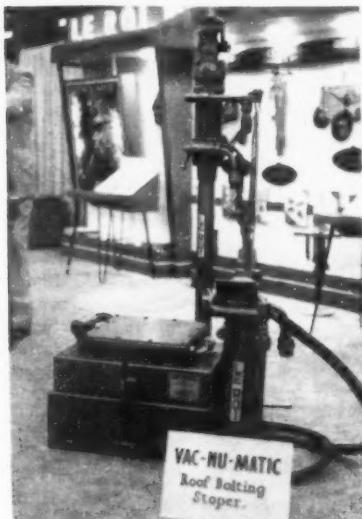
Energy Commission; J. Frederick Corkill, Pacific Coast Borax Company; F. A. McGonigle, Howe Sound Company; and Herbert C. Jackson, Pickands Mather & Company. This Metals Section has long been a main attraction at the Exposition.



70-TON PAYLOADER Kenworth-Dart's 804-B



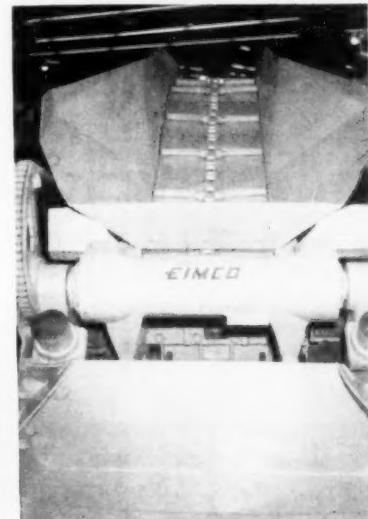
STOODY rebuilds mining parts by arc welding



LE ROI'S roof bolting stoper



GATE's new cold bond Vulcoline



EIMCO's new rock loader

State of Metal Mining Today

The regular panel on "State of the Metal Mining Industries" always draws a crowd and this year was no exception. Simon D. Strauss, vice president, American Smelting and Refining Company, again covered the Nonferrous Metals. He reported that unknown base metal deposits were being discovered all over the world at record rates, and that the Korean War played a big part in expanding plant capacity. Most importantly, he said, there would be no shortage of these metals for consumer use for many years. The post-World War II fashion to classify copper, lead, and zinc as scarce was ended. European use of these metals is growing faster than United States use, he pointed out, despite record business activity in United States.

Herbert C. Jackson, managing partner, Pickands Mather & Co., foresaw domestic production of iron ore as 63,000,000 tons in 1958. Demand in 10 years could be as high as 200,000,-



SKOOPER is Koehring's loader

000 gross tons, he predicted.

Boron use will double to 2,000,000 annual tons in the next 10 years, reported J. F. Corkill, vice president and general manager, Pacific Coast Borax Company. The quantities that might be used for boron aircraft fuels are so large that production might

challenge skills of the mining industry, he also reported.

Today's domestic demand for aluminum, 1,750,000 annual tons, could be raised to 3,000,000 tons by 1960 or 1961, said Walter Rice, president of the Reynolds Mining Corporation. He also recommended that the government do something to protect American industry from glutting an oversupplied market.

Exploration Techniques

Elimination of large areas with no mineral productive possibilities can be quickly done by use of airborne magnetic and electromagnetic surveys, reported C. E. Michener, vice president Canadian operations, International Nickel Company of Canada, Limited. Nine times out of 10 an anomaly discovered by these methods contains sulphide, but only one out of every 100 contain economic minerals values, he added.



Rear-Dump "Eucs" have payload capacities of 10 to 50 tons— are powered by engines of 128 to 670 total h.p. . . . have loaded speeds up to 41 mph.

For Lower Hauling Costs in Mines and Quarries Check Euclid Performance

Open pit mine and quarries the world over have standardized on Euclid equipment for moving earth, rock, coal and ore on tough off-the-highway hauls. They know from years of experience on their own operations that "Eucs" get more work done every shift—that production cost is lower than with other types and makes of equipment.

Euclid has a complete range of sizes and models to fit every job requirement—rear dump and bottom dump haulers, self-powered scrapers and the world's most powerful crawler tractor. Your Euclid dealer will be glad to provide a production-cost estimate on your present or planned operations—be sure to see him before you replace or add to your equipment fleet—and have him show you why Euclids are your best investment.

EUCLID Division of General Motors Corporation
Cleveland 17, Ohio



Bottom-Dumps carry 13, 17 and 25 cu. yds. struck . . . special coal hauler trailers have capacities of 25, 40 and 51 tons. Full length, unobstructed door opening make these "Eucs" ideal for dumping free-flowing material into drive-over hoppers.



The TC-12 Crawler has 2 engines and independent track drive . . . 402 net h.p. . . . full power shift . . . top speed of 7.8 mph. This "Euc" tractor has unequalled workability for heavy dozing, ripping and similar work in mines and quarries.



This "Twin" Scraper has 2 engines with Torqmatic Drive . . . all wheel drive permits self-loading . . . struck capacity is 24 cu. yds. There are six other Euclid Scrapers, overhung engine and six wheel types, with struck capacities ranging from 7 to 24 yds.—9 to 32 yds. heaped.



EUCLID EQUIPMENT

FOR MOVING EARTH, ROCK, COAL AND ORE

United States

Personalities in the News

THOMAS W. MITCHAM, consulting geologist and mining engineer, has moved his office from Flagstaff to Tucson, Arizona. In addition to conducting his consulting business, Dr. Mitcham will give lectures for two graduate courses in geology at the University of Arizona.



David H. Orr, Jr. was recently promoted from chief engineer to mine superintendent at the Morenci, Arizona branch of Phelps Dodge Corporation.

Arthur Bigley recently retired as general manager of the Western Mining Operations of the Anaconda Company. Mr. Bigley is a graduate of Colorado School of Mines and has been associated with Anaconda Company since 1913. He is a 1950 recipient of the Colorado School of Mines merit award for achievement in the mining industry.

Jack H. McWilliams, geological engineer for Aluminum Company of America since 1942, has been appointed manager of ore exploration of the company's mining division. Mr. McWilliams succeeds Dr. A. H. Sutton, chief geologist since 1953, who will perform special assignments in Alcoa's geological program.

Russell R. Richards has been elected president of Western Gold & Uranium, Inc., succeeding Ralph G. Brown who was named chairman of the board. Mr. Brown, one of the company founders, has served as president since 1951, and will continue to serve as treasurer in addition to his duties as board chairman. Mr. Richards is a mining and metallurgical engineer and a graduate of the University of Utah. He has had broad experience in the United States and South Africa with such companies as American Smelting & Refining Company, Anacoda Company, and more recently O'Okiep Copper Company.

James L. Stevens has been named division director of quality control for the Hayden mill of the Ray Mines Division, Kennecott Copper Corpora-

WILLIAM A. BLOMSTRAN (right) has been named district manager of the Port Hendry district, Republic Steel Corporation, Mineville, New York, replacing FRANCIS J. MYERS who has retired. Mr. Blomstran has worked at both the Mineville and Lyon Mountain, New York, properties of Republic Steel Corporation, as engineer and superintendent of mines, and has done special appraisal work in Mexico, Canada, and in the United States. He is a graduate of Michigan College of Mining and Technology.



tion, Hayden, Arizona. Mr. Stevens has been employed at the Hayden plant since 1922. In 1948 he was named assistant mill superintendent, and mill superintendent in 1951. In June 1957 he was assigned as consultant for special metallurgical problems and remained in that assignment until the recent change.

Charles Huffman has been transferred to the Hayden smelter of the Ray Mines Division, Kennecott Copper Corporation, Hayden, Arizona, as test engineer. Until recently he was senior chemist for Kennecott's Nevada Mines Division at McGill, Nevada. He received his degree in mining engineering from the Missouri School of Mines in 1948.

G. D. MacDonald, superintendent of the Columbia Mining Company, Cedar City, Utah, received the Professional Degree of Engineer of Mines during recent graduation exercises at the University of Utah. The degree is awarded in recognition of outstanding professional accomplishment of a University graduate, and has been awarded only five times in the University's history.

Ray R. Adams is project manager for American Cement Corporation's construction program at Clarkdale, Arizona, where a new cement plant is being erected. Contract for the construction was awarded Fisher Contracting Company of Phoenix; R. Heinke, Clarkdale is resident manager.

John Owens is now geologist for Ozark Ore Company in Ironton, Missouri. Mr. Owens was formerly employed as Cuyuna Range geologist for the M. A. Hanna Company at Crosby, Minnesota. He is succeeded by Larry Trost, a recent graduate of the University of Minnesota.

Marcel A. Cordovi, a member of the Atomic Power Developments Section of International Nickel Company, Inc.'s Development and Research Division in New York, recently presented a paper on "Selecting Materials For Nuclear Power Stations" at the Seventh International Congress of Mechanical Engineers at The Hague, Netherlands.

Leslie T. Tracey, an employee at the St. Joseph Lead Company's Balmat mine, Balmat, New York, was awarded a Medal of Honor by the Joseph A. Holmes Safety Association for saving the lives of two men caught beneath a rockfall occurring in the mine.

Robert Denny has been appointed senior industrial engineer for the Nevada Mines Division, Kennecott Copper Corporation, McGill, Nevada. Mr. Denny formerly was employed as a mining engineer with the Morenci Branch, Phelps Dodge Corporation, Morenci, Arizona. He received his engineering training at the University of Arizona and later spent 15 months at the Swiss Federal Institute of Technology, Zurich Switzerland, in graduate and research work in metallurgy.

V. John Eisinger was awarded the Li Foundation Scholarship by the faculty of the Mackay School of Mines

I. G. IRVING, formerly of Butte, Montana, is now engaged in mining geologic consulting work in association with the Investment Exchange, 706 Securities Building, Seattle, Washington. Mr. Irving was co-manager of the Norwich manganese mine at Butte, Montana, until the mine was shut down.



of the University of Nevada. Mr. Eisinger will begin his graduate studies this fall.

W. F. Jones has been appointed director of metal sales and procurement of the Calumet Division of Calumet & Hecla, Inc., with headquarters in Chicago, Illinois. Mr. Jones will handle sales and exchanges of refined copper produced by the company's mines and refinery in northern Michigan.

Dell W. Carlton has been appointed assistant chief engineer with the Erie Mining Company at Hoyt Lakes, Minnesota. Mr. Carlton formerly served as district engineer for Pickands Mather & Co. on the Cuyuna Range.

Coleman W. Morton and Henry H. Patton have been elected to the board of directors of the Sabre-Pinon Corporation, New York. Mr. Patton, an associate in Kuhn, Loeb & Company, New York, replaces J. R. Dilworth, who recently resigned. Mr. Morton is executive vice president and director of Capital Research & Management, Los Angeles, California and a director of South American Gold & Platinum Company, Pato Consolidated Gold Dredging, Ltd., and Anglo-Ecuadorian Oil Fields, Ltd.

Ralph G. Bates, development engineer, has been promoted to the position of general sales manager with Kaiser Engineers, Oakland, California. In his new position, Mr. Bates will direct sales activities of the organization's engineering and construction services in the nuclear, petroleum, thermal power, and minerals industries.

HUGO E. JOHNSON (right) was recently elected president of the American Iron Ore Association, Cleveland, Ohio. He succeeds FRANKLIN G. PARDEE who is retiring. Mr. Johnson has been with the association since 1954, first as vice president and more recently as vice-president and secretary. Mr. Pardee, who has been president of the association since 1952, plans to make his home in Crystal Falls, Michigan, where he will open an office as consulting mining engineer and geologist.





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When the going is soft, *any* shovel cable may do. But the going is more often rough than easy—and not all shovel cables perform alike! They are not made alike.

Anaconda SH-D Shovel Cable, for example, is made by people who know mining problems firsthand—we're miners ourselves.

The insulation is a special high-grade butyl that withstands ozone, heat and moisture. Patented rubber cores cushion the ground wires and help prevent breaks from kinks and runovers. The neoprene jacket

is extremely tough and abrasion-resistant. Every design and component has been job-tested under the most difficult conditions.

Why not call on the especially qualified Man from Anaconda to help with your cable problem? Or see your local Anaconda distributor. For new descriptive Bulletin DM-5818, "Anaconda Securityflex Portable Cables for the Mining Industry," write: Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.



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FOR **SHOVEL CABLE**

Newsmakers in International Mining

RICHARD E. MIERITZ, formerly of Phoenix, Arizona, is now at Room 915, 150 Broadway, New York. Mr. Mieritz, a mining consultant, recently returned from Brazil where he completed examination of several diamond properties for United Diamond Field of Brazil. Mr. Mieritz's move to New York will facilitate his concentration on foreign work in which he is very interested.



Roy Jure, formerly manager of the American Metal Company, Ltd., in Toronto, Canada, is now with American Metal Climax, Inc., in New York City. Mr. Jure is assistant manager of the Exploration Division.

Luis A. Nogales is in Peru as a consulting mining engineer. His residence is at 622 Avenida Arequipa, Lima.

Enzo de Chetelat, formerly mining geologist for the U. S. operations mission to Tunisia, has been transferred to the International Cooperation Administration in Washington, D. C.

Shri K. C. Maithal has been appointed superintending mining engineer to the government of India and posted at Nagpur, India. Shri Maithal is a mining engineer and has held positions with the government of India, government of Ceylon, and private concerns of India and Ceylon.

Ernest N. Banks has been appointed plant manager of Rio Tinto Dow Limited's new thorium plant now under construction near Elliott Lake, Ontario, Canada. Mr. Banks will be in charge of all local activities of Rio Tinto Dow in the Algoma area.

R. K. Sinha, assistant mineral economist with the Indian Bureau of Mines, has been transferred to Nagpur, India. All of the offices of the Indian Bureau of Mines, with the exception of regional offices at Delhi and Calcutta, have recently been moved to Nagpur.

Douglas Parent, formerly associated with St. Fabien de Panet mine in Canada, has recently moved to Northern Nigeria in West Africa to become general manager of T.A.M. Limited.

K. Shaw, mining geologist with Biani, Limited in Ghana, West Africa, has recently returned to London, England to complete a year's study at the Royal School of Mines.

G. Hunt, who has been assistant manager of Consolidated Diamond Mines of South West Africa, has been appointed general manager of Williamson Diamonds, Limited in Tanganyika.

T. V. Baines has been appointed consulting geologist to the African activities of the International Nickel Company of Canada.

Following his retirement as manager of the International Division of Hewitt-Robins, Inc., and manager of their South African subsidiary, Robins Conveyors, Ltd., **Harold Von Thaden** will continue to be associated with the company in a consultative capacity. His headquarters are located in Paris—Hewitt-Robins International, #9 Blvd. Italiens. Replacing Mr. Von Thaden as manager of the International Division is **John J. Sheehan**.

Edwin E. Dowell, former field relations director of Reynolds Metals Company at Richmond, Virginia, was recently named public relations director, Western Mining Divisions, Kennecott Copper Corporation. Mr. Dowell will direct and correlate Kennecott's public relations in Utah, Nevada, Arizona and New Mexico. He previously has been associated with the United Press in Canada and Alaska and with Standard Oil Company of New Jersey in Western Europe, Northern Africa and the Middle East. Before joining Reynolds Metal Company, Mr. Dowell was public relations coordinator for Standard-Vacuum Oil at Capetown, South Africa.

Bruce W. Bryan, former assistant chief engineer with the Anglo Lautaro Nitrate Company, Antofagasta, Chile, is now employed as maintenance scheduling foreman at the reduction plant of Kennecott Corporation's Ray Mine Division, Ray, Arizona.

J. D. Johnson, former assistant manager at Bancroft Mines Limited, Northern Rhodesia, has been transferred to the Rhokana Corporation as assistant manager. He will be succeeded by **C. H. Walters**, former assistant manager at Nchanga Consolidated Copper Mines, Ltd., Northern Rhodesia.

A delegation of Polish chemical industry officials recently inspected the Noralyn mine and plant of International Minerals & Chemical Corporation, and the company's Bonnie chemical plant at Bartow, Florida, as part of an official tour of American chemical and related operations. Members



THOR AMDAHL (left), managing director of Fosdalen Iron Ore Company, at Malm, Norway, and **LEIF HALVORSEN**, mine superintendent at Fosdalen, recently visited shaft sinking operations at various mines in Canada and the Union of South Africa before going on to San Francisco to attend the American Mining Congress. Mr. Amdahl returned to Norway via the Orient, while Mr. Halvorsen went on to visit shaft sinking operations in the United States.

WILLIAM ROGERS WADE, consulting mining engineer of Marysville, Montana, recently completed the design and construction of a new copper concentrator for the Cia Minera Buena Vista S.A. at its mine near Cabanas, Cuba. The plant is being enlarged to treat 500 to 550 tons per day of the solid pyrite ore containing 7 percent copper as chalcocite. After the copper is recovered from the ore as 30-35 percent copper concentrates, the pyrite tailings are to be sold for their sulphur content or burned locally and made into sulphuric acid.

of the group include: **Bronislaw Taber**, vice minister of Poland's chemical industry; **Stanislaw Miernik**, director general; **Konstanty Laidler**, director, technical department; **Wladyslaw Plaskura**, director, chemical synthesis department; **Edward Zawada**, central union director, and **Antoni Poniatowski**, central planning committee vice-director.

J. M. Herndon has been appointed assistant general manager of Quebec Iron & Titanium Corporation, Montreal, Canada. Mr. Herndon was formerly employed as general superintendent of Cramet, Inc. at Chattanooga, Tennessee.

Ivar Thomas is now employed as mining engineer with Trafikaktiebolaget Grangesberg-Oxetsund (TGO) at Strassa, Sweden. Mr. Thomas previously served as sales manager of the Rock Drill Division of Atlas-Copco in Sweden.

Bruce E. Kennedy, mining engineer employed by Pickard Mathers & Co., Duluth, Minnesota, has been placed in charge of exploration and geological activities in Canada with headquarters in Montreal, Quebec.

Shahid Noor Khan, of Karachi, Pakistan, Aran Buranasiri of the Department of Mines, Bangkok, Thailand; and **Jack D. Stavropoulos**, University of Athens, representing the Atomic Energy Commission of Greece, recently visited uranium mining operations in the United States.

N. T. Gilmour, formerly employed by Jantar Nigeria Ltd. at Bos, Nigeria, is now associated with Mufulira Copper Mines Ltd., Mufulira, Northern Rhodesia.

J. Reysenbach has accepted a position as technical assistant in the metallurgical department of Union Corporation Ltd. at Springs, South Africa. Mr. Reysenbach was formerly mill superintendent with Uis Tin Mining Company (SWA) Ltd. at Uis, South West Africa.

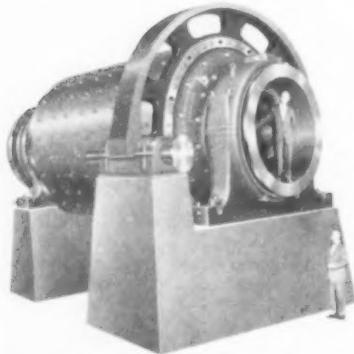
Arsen Ristic has recently become associated with the Majdanpek Copper Mines in Majdanpek, Yugoslavia. Mr. Ristic was formerly with Trepcza lead and zinc mines and smelters at Zvecan, Yugoslavia.

PRODUCTION EQUIPMENT PREVIEW



Transloader Developed By Sanford-Day

Here's a new "Gismo" unit, all rubber-tired, which has recently made its appearance at the American Mining Congress exposition in San Francisco. The new Transloader is a one-man operated self-loading and self-dumping truck. This unit can work constantly, all day long, without the need of accessory equipment. Having a capacity of five cubic yards, the unit is capable of speeds up to 20 miles per hour, in either forward or reverse. Investigate the full line of Gismo equipment, including Drill Jumbos, and ramp car loading system. Write to Sanford-Day Iron Works, Inc., Dale Avenue, Knoxville, Tennessee.



12-Foot by 12-Foot Marcy Largest Rod Mill Built

According to the Mine & Smelter Supply Co., 3800 Race St., Denver, Colorado, this size rod mill is the largest built to date. The company has recently shipped

two of these Marcy Open End Rod Mills to the new Duval Sulphur and Potash Co. copper concentrator near Tucson, Arizona. Each mill will handle 6,000 tons per day, grinding from $\frac{3}{4}$ -inch to approximately 10 mesh.

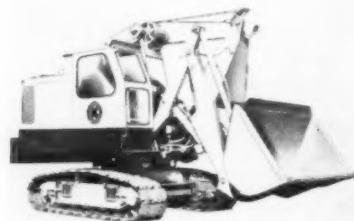
Each mill is powered by a 1,250 hp motor and takes a rod charge of 307,000 pounds. These mills incorporate the Marcy "low pulp line" principle of operation. Write to the company for additional information.



World's Largest Scraper By R. G. LeTourneau, Inc.

Here's a new scraper by R. G. LeTourneau, Inc., which is the latest step by the company in the development of this type machine, first pioneered by LeTourneau in 1938.

Developed for large scale strip mining operation, the first units will be in the 70 and 125-ton class, roughly equivalent to 50 and 100-cubic yard capacity. The new 70 ton unit, was recently exhibited at the San Francisco AMC exposition. Major difference between this super-sized scraper and conventional units, is that each wheel will have an individual electric motor geared directly to its inner rim, providing greater traction and working power. Power is supplied by the machine's 600-hp Diesel-electric dynamo. For additional information write to the company in Longview, Texas.



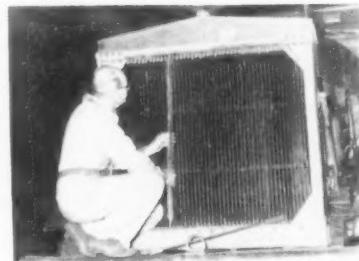
New Concept in Digging, Loading, by Koehring

The "Skooper," offering a revolutionary concept in speed loading, has been

PEP is just what new equipment, increased mechanization, and new methods can give to your mine, mill or smelter. This PEP section is MINING WORLD's way of making available to you some of the finest current information on mechanization.

introduced by Koehring. By using the fast swing of an excavator turntable and a seven foot independent crowding action, the "Skooper," operated with a 70 hp Diesel engine, can load up to 400 tons per hour, amounting to 5.7 tons for each horsepower hour, an important economy feature in loading operations.

Available with buckets ranging from $1\frac{1}{2}$ to $2\frac{1}{2}$ cubic yards, the unit has a cutting height of 17 feet, 4 $\frac{1}{2}$ inches. A 9-foot 8-inch maximum clearance at end of the dump is well within the height necessary for loading over side or end of trucks, as well as into railcars. Easy change-over to a 5-yard hoe, 3-yard clamshell or dragline, or a 10-ton lift crane adds to the "Skooper's" versatility. According to the manufacturer, the unit may be used underground as well as on the surface. For additional information write: Koehring Division, Milwaukee 16, Wisconsin.



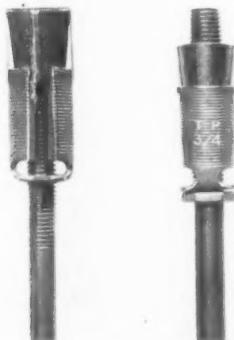
Radiator Core Segments Save Time and Money

L and M Radiator Service, Inc., 618 W. 41st Street, Hibbing, Minnesota, have now available replaceable Withnell radiator tubes which can be mounted in your present truck or industrial engine radiator.

Should your present radiator become damaged or plugged, it could involve taking the entire unit off for repairs. With the new Withnell tubes, only the damaged segments have to be removed and replaced with new ones. With this new system, the radiator will function (by block off holes with cork or wood) even if several tubes are missing. This then will

not tie up a truck or engine while waiting for replacement parts.

Send for free explanatory catalog for the full story. Write company at address given above.



Thompson Products Have New Expansion Shell

Called "Top-Tite," this new roof bolt expansion shell, has undergone a severe testing program under actual mine conditions to prove its effectiveness. According to the company, "Top-Tite" shells hold excellently in any type of ground, hard or soft, due to the fine-tooth leaves, which give an even grip over their entire surface. They transfer the bolt load without destroying the material in the hole-wall. This, in comparison to large teeth, which tend to crush and weaken the anchorage material. According to the company, bolting time can be reduced measurably with these new shells. The design provides for maximum expansion in a minimum amount of time.

Investigate these new shells further, write to: Valve Division, Thompson Products, Inc., 1455 East 185th St., Cleveland 10, Ohio.



Ortruc, Inc., Produces New Underground Truck

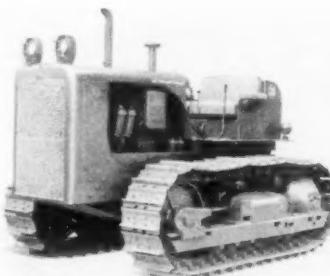
Introduction of a new General Utility Underground Truck, the Oremaster UTILI-TRUCK, was announced by Gilbert Weidlich, president of Ortruc, Inc., of St. Louis.

Designed for heavy duty operation, the husky UTILI-TRUCK has a 3-inch thick steel hood and 3-inch steel decking on the bed. It can be used for general purpose flat-bed operations, as a personnel truck, as a parts and tool carrier or, with the installation of a tank it can be used as a special lubrication vehicle. The UTILI-TRUCK comes equipped with power take-off for operating generators, winches, compressors, hoists, welders, etc.

Built on a G.M.C. chassis and powered by G.M. 2 and 4 cylinder diesels complete with exhaust scrubbers, the Ore-

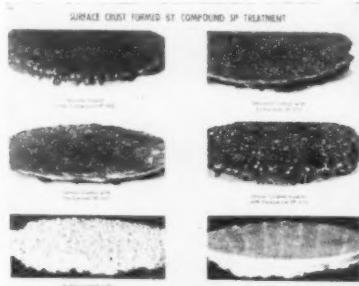
master UTILI-TRUCK is available in ½ ton to 2-ton sizes on variable wheel bases with choice of 2 or 4-wheel drives and 2-wheel drive with no-spin differential. Minimum wheelbase is 76 inches.

Complete information is available from Ortruc, Inc., 320 S. Grand Blvd., St. Louis 3, Mo.



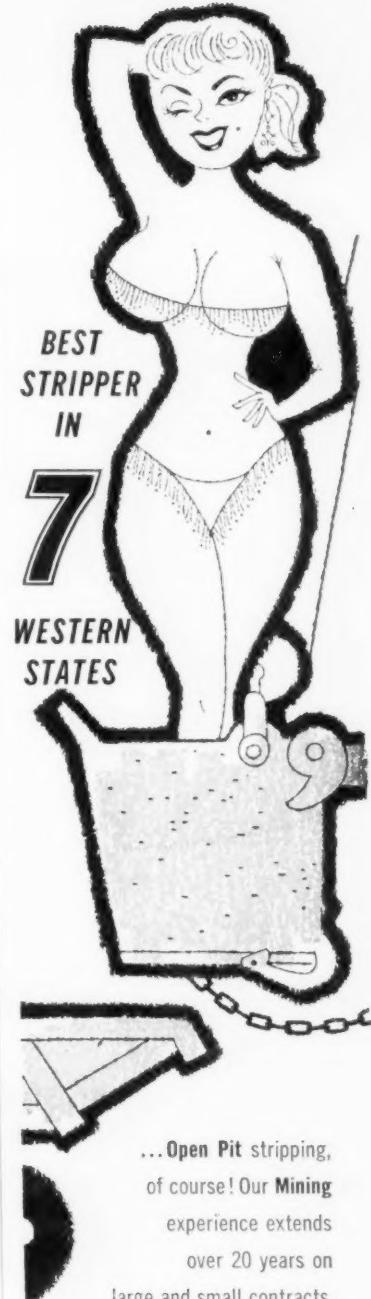
I-H Introduces A New Diesel Crawler Tractor

International Harvester Company, 180 North Michigan Ave., Chicago 1, Illinois, recently introduced a new 13 ½ hp Diesel crawler tractor, designated the International TD-20. This unit offers a major advance in crawler design in its power class with a six-speed full reverse transmission. With a single lever, the company points out, an operator can shift the transmission through six speed ranges. A separate lever operates the forward-reverse "shuttle bar" control which provides six speed ranges forward and six in reverse. Because of this unique design, TD-20 operators can make full use of the high reverse speeds available because of the planned shift pattern. When the directional "shuttle bar" shift lever is moved the tractor travels either forward or reverse in any pre-selected speed range. Write to company for more information.



Prevent Stockpile Erosion With Coating Compound

A new compound that blankets and protects outdoor stockpiles against loss from wind or rain erosion has been developed by Johnson-March Corporation. The spray-applied solution contains specially developed additives for maximum coverage and penetration. Called compound SP, the solution is a blend of synthetic, organic, long chain polymers in a water base that form a thin crust which is tough, durable and highly resistant to weathering. Compound SP is described as being inert, unreactive and non-toxic and without adverse effect on subsequent processing of sulphur, metal ores, etc. For details write Johnson-March, 1714 Chestnut St., Philadelphia 3, Pennsylvania.



...Open Pit stripping,
of course! Our Mining
experience extends
over 20 years on
large and small contracts.

for that brand of performance,
we have the men,
the equipment, the know-how.

ISBELL CONSTRUCTION COMPANY

P.O. Box 2351 • Reno, Nevada
Telephone FAirview 3-7135



22½-ton Mack LVX

SURE WAY TO TURN A PROFIT

From the moment you start hauling ore on Macks, you'll find what mine operators the world over have discovered—that, for the utmost in economical operation and long service life, you can't beat a Mack!

Heavy-duty Mack dumpers are engineered from start to finish to handle the most punishing hauling jobs. Single-unit all welded frames that pay dividends in extra years of service and rock-bottom down time . . . outstanding economy that cuts hauling costs to the bone . . . and unmatched performance and durability that mean Macks are hauling more profit-making payloads, month after month, with time out for only routine servicing.

You get other important advantages from Mack: exclusive Mack Balanced Bogie with Power Divider, that takes you in—and out—of places where other trucks just can't go . . . Mack-built clutches, transmissions and differentials specially engineered to work together for the best possible performance.

Mining operators everywhere are benefiting from these Mack profit-making features. Give your Mack branch or distributor a call for the names of Mack users near you. Let them tell you about the "extras" they get from Macks—in economy, performance and long service life—that can mean a more profitable operation for you. Mack Trucks, Inc., Export Division, Plainfield, New Jersey, U.S.A. Makers of world-famous trucks, buses and fire apparatus. Distributors in principal cities of the world.

MACK
first name for
TRUCKS



30-ton Mack LRSW

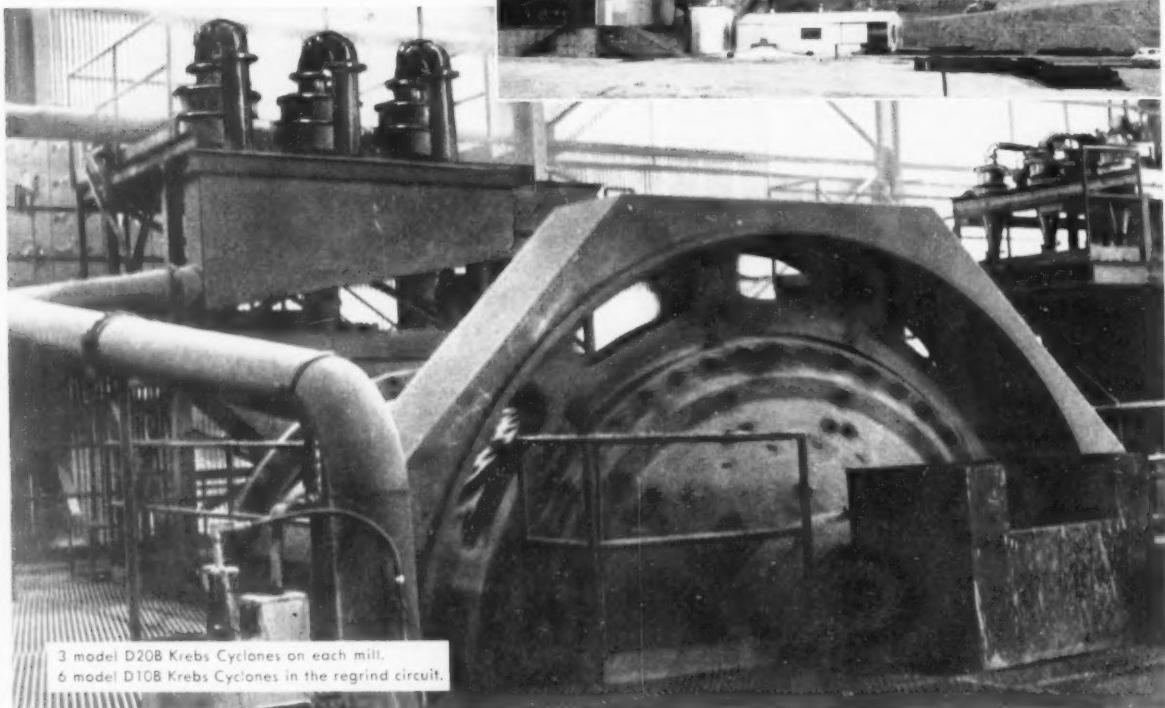


34-ton Mack LRVSW



15-ton Mack LRX

New copper concentrator does all its classification with cyclones



Pima Mining Company's Arizona plant, starting up in late 1956, is the first U. S. copper concentrator to classify entirely with cyclones.

Pima and nine other U. S. and foreign copper concentrators now have Krebs Cyclones for all or a major part of their tonnage. Operational costs can be substantially lower than with conventional classifiers. Capital cost is about 30%. The metallurgical advantages are usually the primary consideration . . . the flotation engineer may now have an optimum pulp density, and a selective grind of middling grains that reflects in increased concentrate grade as well as lower tailings.

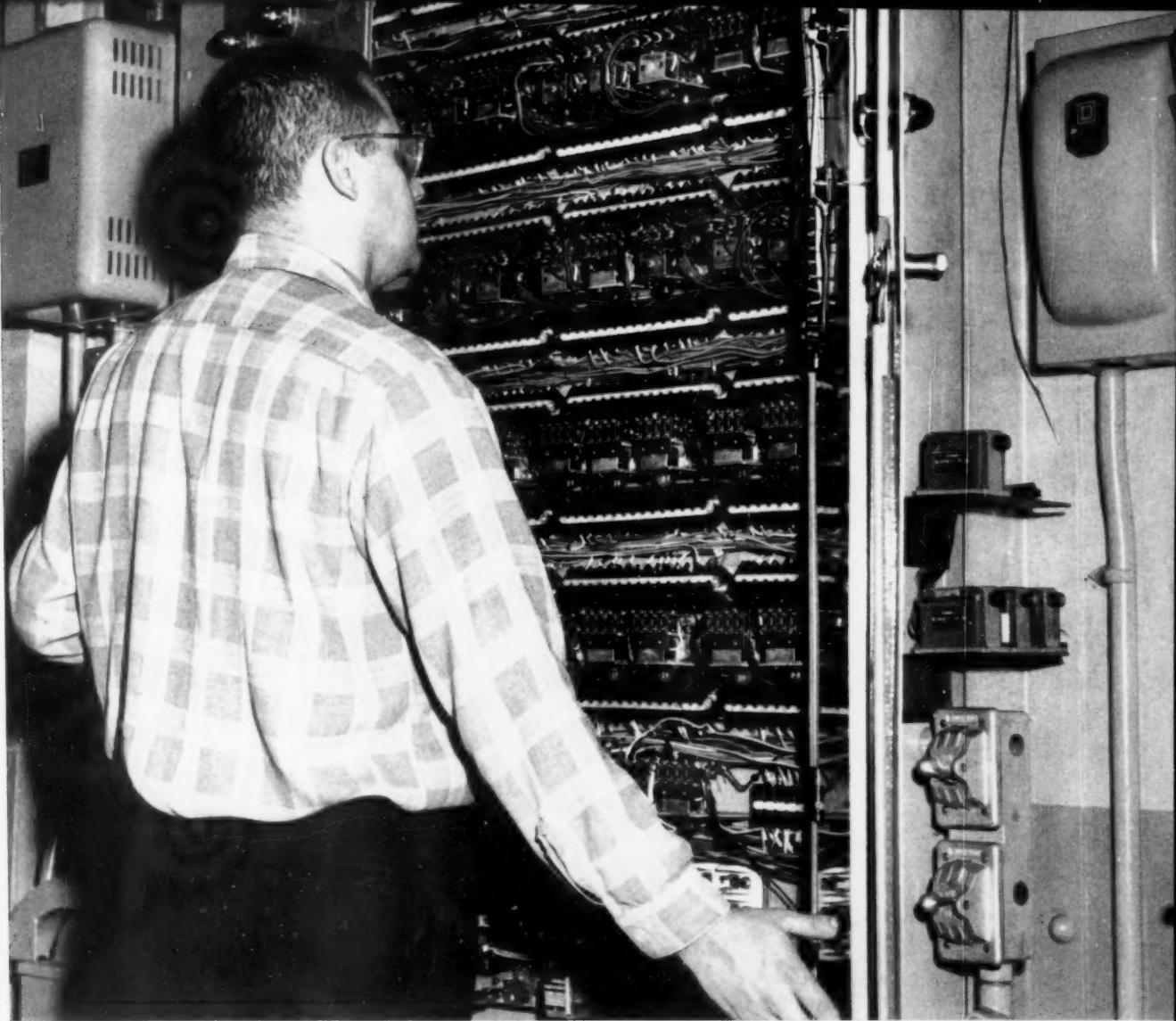
Krebs Cyclone Bulletins 850 and 1400 further describing these techniques are available on request.



E Q U I P M E N T E N G I N E E R S I N C.

41 SUTTER STREET

SAN FRANCISCO 4, CALIFORNIA



BEHIND THE SCENES of the new electronically controlled, fully automatic factory for making Du Pont Electric Blasting Caps (both regular and delay).

Automatic loading and electronic controls give you Du Pont Electric Blasting Caps that are even more reliable, more uniform than before

Let us take you behind the scenes at the world's most modern blasting cap plant. Then, you'll see why Du Pont Electric Blasting Caps, both regular and delay, are years ahead in reliability, uniformity and dependability.

Any possibility of human error has been completely erased from this scene. Every step in the process, from automatically loading the shell (and inspecting it 3 times during loading alone), to applying the shielded shunt and paper band is controlled electronically.

This revolutionary approach

means that every Du Pont electric blasting cap—regular or delay—*must* meet our rigid standards at *every step* or it will be automatically rejected by one of the dozens of electronically controlled "watchmen."

This elimination of the human equation means that all Du Pont

Electric Blasting Caps are even more uniform, more reliable, more dependable than ever before.

And you get all these benefits at NO INCREASE IN COST. Call your Du Pont representative or write to E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Delaware.

DU PONT BLASTING CAPS



Products of DuPont Research

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

ALLIS-CHALMERS CRAWLER TRACTORS . . . first choice on more and

ALLIS-CHALMERS
HD-21



225-hp turbocharged engine

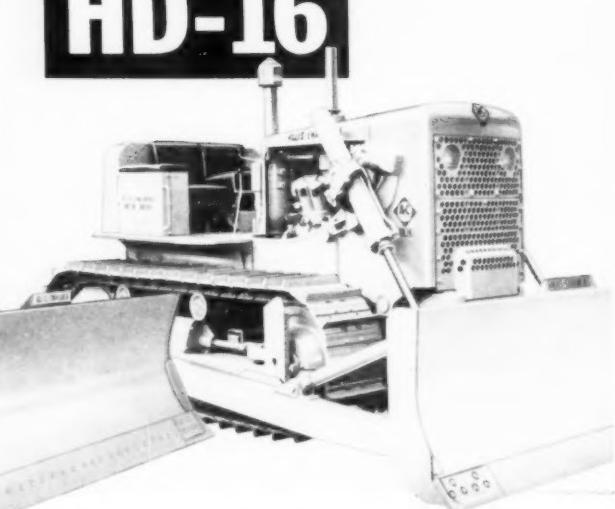
Hydraulic torque converter drive

56,260 lb (approx. as shown)

The new HD-21 brings you live power for today's big-tractor jobs—and torque converter drive puts it to work automatically. The HD-21 offers more work capacity—dollar for dollar—than any other big crawler tractor you can buy.

HD-21A illustrated—Two other models available

ALLIS-CHALMERS
HD-16



CHOICE OF TWO OUTSTANDING DRIVES

Hydraulic torque converter

150 net engine hp

39,090 lb (approx. as shown)

All-gear drive

141 belt hp

125 drawbar hp

Get up on the HD-16 yourself—and see how it handles jobs ordinarily assigned only to bigger, more expensive crawler tractors. You'll sell yourself—just as more keen-eyed construction men do every day.

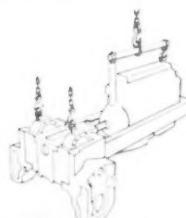
HD-16DC illustrated—Five other models available

THE ONLY COMPLETE LINE OF CRAWLER TRACTORS

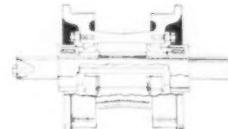
Pioneered
and proved by
Allis-Chalmers
Engineering
in Action



Torque Converter Drive gets more work done—automatically provides the right pull or push for every load, at maximum speed for existing conditions. (Available in HD-21 and HD-16 only.)



Unit Construction saves valuable time . . . lets you remove any major assembly without disturbing adjacent assemblies.



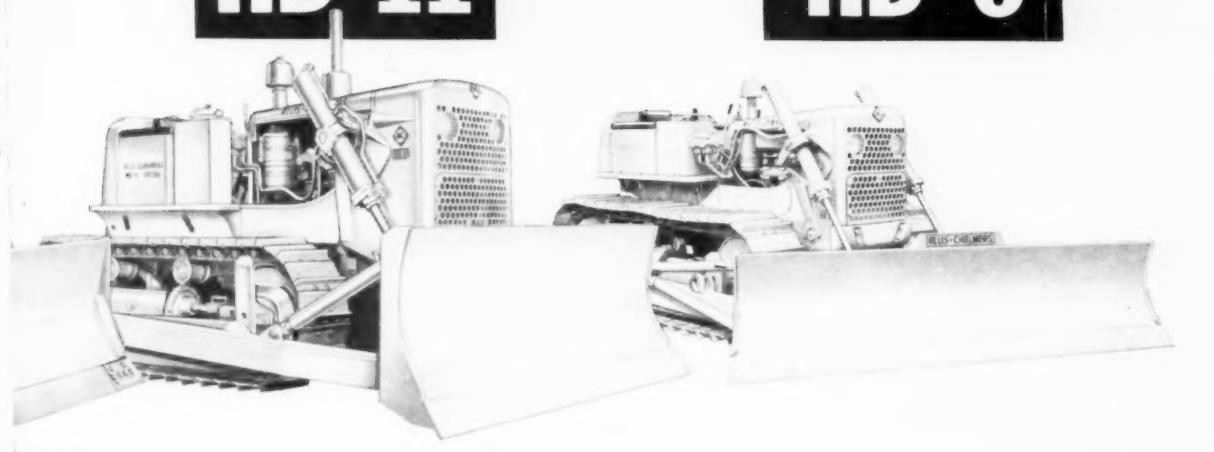
1,000-Hour Lubrication intervals for truck wheels, idlers, support rollers . . . changes daily greasing time into production time.

Look ahead...move ahead...and stay ahead

more tough jobs

**ALLIS-CHALMERS
HD-11**

**ALLIS-CHALMERS
HD-6**



94 belt hp

25,960 lb (approx. as shown)

The HD-11 is setting new standards in its size range . . . offers you dozens of work-boosting advantages, including the industry's easiest shift pattern. A single shift takes it from any forward speed to any reverse—gets short-cycle jobs done faster, easier.

HD-11B illustrated—Two other models available

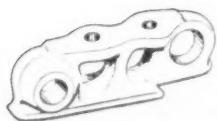
63 belt hp

16,470 lb (approx. as shown)

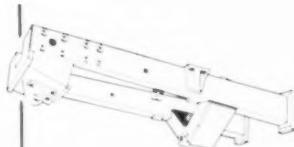
Here's up to 15,500 lb drawbar pull. The HD-6 is the only tractor near its size with big-tractor design advantages—for example, All-Steel Box-A main frame and engine-mounted dozer with direct-lift cylinders for improved weight distribution, accurate dozing and long life.

HD-6E illustrated—Three other models available

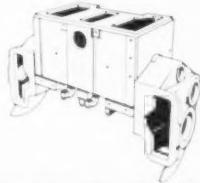
THAT GIVES YOU ALL THESE ADVANTAGES IN EVERY SIZE



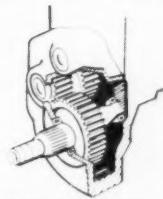
True-Dimension Track
heat-treated and machined in the industry's most modern facilities, is setting new track-life records on every type of work.



All-Steel Box-A Main Frame soaks up shock and strain . . . provides improved weight distribution and equipment mounting.



One-Piece Steering Clutch and Final Drive Housing with extreme rigidity and strength . . . line-bored to provide precise alignment of gears and shafts.



Straddle Mounting of All Final Drive Gears with tapered roller bearings on both sides of short, large-diameter shafts . . . provides extra gear life.

ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN

with ALLIS-CHALMERS



Roebling Presents

THE NEWEST CONCEPT IN WIRE ROPE

Herringbone*

two
ropes in
one!

Here is a combination that has proved itself during three years of field testing. A welcome addition to Roebling's great line of wire ropes, Royal Blue Herringbone is both a regular lay and lang lay wire rope!

So, in one rope you have the greater flexibility and abrasion resistance of lang lay construction *plus* regular lay's superior stability under severe operating conditions.

Preformed Herringbone is made of two pairs of lang lay strands, and two strands of regular lay which separate the two pairs of lang lay—all of it made of Type 1105 rope wire.

For three years Herringbone has been used for general hoisting, holding and

*Reg. app. for

closing lines, shovel ropes, wagon scraper ropes and dragline ropes. Without reservation, its performance has been superior to that of any other rope used for the same jobs . . . even in the hands of inexperienced personnel! *Its proven capabilities clearly suggest its use for all jobs where steel core ropes are normally used.* See your Roebling salesman for all the facts or write Wire Rope Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey. Roebling Herringbone, the two-in-one rope to meet the *doubly* stringent demands of today's economy.

ROEBLING 
Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation



precipitates—SOUTHWEST



Construction of a 23-mile, 3-inch natural gas main line to serve the *Duval Sulphur and Potash Company* mine near Sahuaria, Arizona, is nearing completion. The line, the longest distribution line ever built in Pima County, will furnish gas for the molybdenum recovery phase of the mining operation. It is being built by Tucson Gas, Electric Light and Power Company at a cost of \$140,000, and also will serve the community of Sahuaria and farmers of the area.

Operations at the Hayden Smelter of *American Smelting and Refining Company*, Hayden, Arizona, went on a full custom basis September 1. Some custom tonnage previously treated at Asarco's El Paso Smelter is being diverted to Hayden so that operations can continue without interruption. According to Ben D. Roberts, manager, Southwestern Department, the change was occasioned by the termination of American Smelting and Refining Company's long-standing smelting agreement with the *Ray Mines Division of Kennecott Copper Corporation*. The Hayden plant, Mr. Roberts said, will now be able to offer increased services to producers of copper ores and concentrates and siliceous copper ores, augmenting the capacity and services in the Southwest which for many years were offered principally at the company's El Paso plant. The El Paso plant will continue smelting operations, but at a somewhat reduced scale owing to the diversion of some tonnage to Hayden.

Cement pouring for foundation footings is reported well along at the site of the \$11,000,000 cement plant of *American Cement Corporation* at Clarkdale, Arizona. *Fisher Contracting Co.* of Phoenix is contractor for the plant, which is scheduled for completion in late 1959. American Cement was winner of the U. S. Bureau of Reclamation contract for furnishing cement for the Glen Canyon Dam construction project in northern Arizona.

The *Old Gold Mining Company* has leased the *Allison* mine near Sells, Arizona from *Sawyer Petroleum Company*. Mining production is about 500 tons per month of ore containing gold and high-grade silica. The *Tom Reed* mine near Oatman, Arizona, also held by Sawyer, is being tested by a Kansas group for possible recovery of gold and silver values in the old tailings piles. Results so far have not been conclusive.



American and International Onyx and Marble Company has been formed in Los Angeles, California by a partnership who plan to mine a hill near Death Valley which they believe contains a fortune in onyx. James P. Steel, Della Alston, and Charles Von Walden are associated in the venture. They have purchased the interest of H. C. (Scotty) Degner who made the discovery near Ballarat in 1925. Production is to get underway shortly.

Miracle Mining Company of Taft, California has won a default suit against *Wyoming Gulf Sulphur Mining Company*, and its subsidiary, *Miracle Springs Mining Company*. The Kern County Superior Court gave clear title to the Kern River Canyon uranium claims to *Miracle Mining Company* and cancelled a \$1,000,000 lease-purchase agreement with Wyoming Gulf. *Miracle* had requested lease cancellation after Wyoming Gulf reportedly failed to comply with lease terms, including mine shaft improvements and production. According to Brooks Mann, president of *Miracle* Mining, two men are now readying the mine for production.

Mexico Refractories Company is building a \$2,000,000 refractories plant near Stockton, California. The new plant, with deposits of highgrade refractory clays and sands sufficient for many years' supply, will be the sixth manufacturing plant in the system. A plant at Mexico, Missouri is currently being modernized at a cost of \$1,000,000 and will be completed by the end of 1958.



A 75-ton mill is being erected by *Tungsten Mountain Mining Company* at its property in the Clan Alpine District, 32 miles north of Eastgate, Nevada. The mill was purchased from *Tri State Min-*

ing Company at Mesquite. With aid of a *Defense Minerals Exploration Administration* contract, the company has developed substantial reserves of high-grade tungsten ore. Arthur Lakes, formerly of Spokane, Washington and Nelson, British Columbia, is mining engineer and geologist in charge. B. W. Porter of Seattle is company president.

The *United States Mining and Milling Corporation*'s mill at Silver Peak, Nevada is receiving ore from many small operators around the district. Le Roy Barrett has been shipping gold ore from his mine in the Goldpoint area for some time. A fair grade of mill ore is being encountered in sinking on the vein and it is hoped that the grade will improve with depth. The *Ohio Mining Company*, also at Goldpoint, has had a production of 40 tons daily. This is now being increased to 75 tons daily with the addition of a second shift. Ore shipments are also being made from the *Liberty* dump where recent sampling has proven an additional 5,000 tons of mill grade ore are available.

Copper-silver ore is being mined and shipped from an area between the 700 and 1050 levels of *Bristol Silver Mines Company*'s operations in the Pioche district of Nevada. Laterals are being extended on the 500 and 700 levels in an attempt to develop similar ore. Exploration work on the 1200 level is expected to reach the downward extension of the ore body. Diamond and long hole drilling is continuing in various parts of the mine.

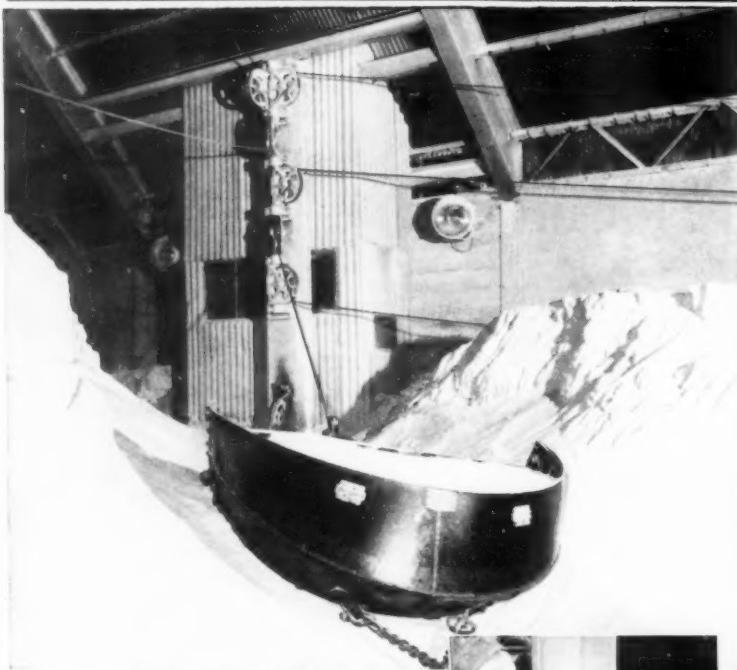
Southwestern Engineering Company of Los Angeles, California has been hired by the *Union Pacific Railroad* to redesign



Spencer Demonstrates Its New Blasting Agent

One of the interesting side trips during the American Mining Congress meeting in San Francisco was sponsored by *Spencer Chemical Company* of Kansas City, Missouri. The firm arranged for a demonstration of its new N-IV prilled ammonium nitrate blasting agent at the Calaveras Cement Company limestone quarry at San Andreas, California. The new blasting agent was used in two areas. The largest blast contained some 28,000 pounds of ammonium nitrate; of this, 23,000 pounds was N-IV using only a $\frac{3}{8}$ -inch detonating cord as primer and the rest was standard materials with a dynamite primer. The other area used 7,000 of N-IV with detonating cord. Spencer says its new material gives the nitrate-oil mixture a blast sensitivity which eliminates the need for other primers. The full force of the larger blast can be seen in the picture above. Fragmentation results were very satisfactory. Spencer has also introduced a heavy-duty, transparent, polyethylene bag for ammonium nitrate. The plastic container has several advantages: it is waterproof in the field; it retains fuel oil mixed with the ammonium nitrate much better than in paper bags because it does not get soggy and hard to handle; can be resealed with tape and stacked after oil has been added through the small opening in the top of the bag.

Bulk Mineral Storage by the SAUERMAN Method



Potash Recovery at Carlsbad

How Sauerman Scraper Storage Reduces Costs



Remote Control

This prominent producer of basic chemicals uses Sauerman 1½-cu. yd. Drag Scraper Machines to reclaim potash at 200 tph. Total area covered is approximately 125 by 370 ft. Building capacity is 60,000 tons.

Here's how a Sauerman Machine cuts costs:

One operator, located in a safe station, overseeing the entire area, can recover practically 100% of all stockpiled material.

All highly machined parts, hoists and motors can be located outside of the building and protected from corrosion and dust.

When parts are replaced—sheaves, clutch or brake linings—the machine is restored to practically new condition, even though it may be twenty or more years old.

Only the Crescent scraper and cables contact the material. The scraper machine can be designed to operate the scraper on top of non-caving material. This allows the scraper to break down any high faces that may be standing.

Sauerman Storage Machines are built for hourly capacities of from 20 to 600 cu. yards. A partial list of producers and manufacturers using some type of Sauerman equipment includes:

Crawford Chemical Co.
Davison Chemical Co.
Division of W. R. Grace & Co.
Duval Sulphur & Potash Co.
F. S. Royster Guano Co.
International Minerals & Chemical Corp.

Lion Oil Co.
Potash Company of America
Red Star Fertilizer
Southern Agricultural Fertilizer Co.
Tennessee Farmers Cooperative
Virginia-Carolina Chemical Corp.

For ways to reduce your material handling costs, request Catalog E, *Bulk Storage by Scraper*, plus Field Report 227 and other reports on the handling of your material by Sauerman Machines.

SOUTHWEST

and operate the rotary furnace at Pioche, Nevada which has been leased from *Combined Metals Reduction Company*. This will be a first step toward pilot plant work on the Krupp-Renn process to separate iron and titanium from the titaniferous magnetite ore which will be mined at Union Pacific's Iron Mountain deposit in Wyoming. *McFarland & Hullinger* of Tooele, Utah have the contract from Southwestern to do the actual mining and shipping 16,000 tons of the ore. *National Lead Company* reportedly is interested in the titanium slag which will be produced by the German process. (The slag is expected to contain 20 to 35 percent TiO_2 .)

Standard Slag Company at Gabbs, Nevada is reported to be producing and shipping 22,000 long tons of iron ore per month from the Minnesota mine near Wabuska, Lyon County, Nevada. Shipments are made to the Port of Stockton, California, and then to Japanese steel mills. Also making steady shipments to Japan are *Dodge Construction Company*, *Nevada Iron Ore Company*, *Segerstrom & Heizer*, and *Mineral Materials Company*.

Frank Riddle and an associate are said to be mining a high-grade talc deposit at Log Springs in the Tonopah-Goldfield area of Nevada. The talc is shipped 108 miles by truck to the mill at Keeler. In July 200 tons were trucked.

The U. S. Bureau of Mines is producing high-purity cerium metal on an experimental basis at its laboratories in Reno, Nevada. Cerium is the most abundant of the rare earths. In its ordinary commercial grade, it has many uses, but the high grade is both difficult and costly to obtain. The Bureau predicts that the new process will ultimately make possible alloys suitable for fabricating electronics and automation devices.



International Minerals and Chemical Corporation completed some important maintenance work during the shutdown period this summer at its Carlsbad, New Mexico operation. Major jobs underground included shortening the pan feeder on No. 2 dump and relining the skip loader at No. 1 shaft. Among the surface projects completed were the installation of a new elevator, the largest in the entire plant, at the south end of the crusher building; new screens in the sylvite refining section; new screens in the desliming section, coupled with a complete redesigning of the circuit; and a new tank to hold finished granular production.

Kermac Nuclear Fuels Corporation's new uranium processing mill with a capacity of 3,630 tons of ore per day, is expected to go into operation next month. It will be the nation's largest. Development work is underway at three *Kermac* mines, and shafts are being sunk for three more mines to produce ore for this mill.

Western Aniline and Chemical Corporation of Tucson, Arizona is reported to have purchased the *Anderson Brothers*' manganese mill at Socorro, New Mexico for \$250,000.

SAUERMAN BROS. INC.

638 S. 28th AVE.

BELLWOOD, ILL.

Crescent Scrapers • Slackline and Tautline Cableways • Durolite Blocks

precipitates—ROCKY MOUNTAIN

Analyzer Makes 250 U₃O₈ Determinations Per Hour

As many as 250 uranium determinations an hour are being made in South Africa by one operator using the new Mark II colorimetric uranium analyzer manufactured by Baird & Tatlock (London) Ltd. The operator shown in the picture need only place the sample test tube in the entrance receptacle. It is then pumped to a colorimeter cell where its transmittance is measured and the result recorded on a strip chart. The sample is returned to the test tube, whereupon a signal lamp indicates the instrument is ready for another test.



For uranium use, the Mark II was developed to monitor various influent and effluent streams in connection with ion exchange beds used to isolate and concentrate uranium in the refining process. It measures uranium concentration colorimetrically at 365 millimicrons as the thiocyanate complex after suppressing interfering ions by reduction with acid stannous chloride. Fresh samples are drawn in rotation from as many as 16 different streams and may be treated, as preselected, with either of two thiocyanate solutions of different concentrations. Measurements are recorded on a strip chart and are pulse coded to identify each source stream. Uranium concentrations outside preset limits initiate visual and audible alarms and a fault warning system signals any malfunction, which may then be quickly located by means of an integral search device.

Rio Tinto Mining Company of Canada, Ltd. has viewed this machine for possible use at its Blind River uranium mines and mills.

trols 3,200 acres of land which includes 160 mining properties.

Climax Molybdenum Company, division of *American Metal Climax Inc.*, is building a new metallurgical testing laboratory near its byproducts plant at Climax, Colorado. The new building will provide two main facilities for Climax research metallurgists—assaying and laboratory testing. In the assaying section, two chemists will be provided with the latest equipment for analytical assaying to determine the trace metal content in the mill products. In the metallurgical section, tests will be conducted to improve the recovery of valuable minerals in the Climax milling process, and to improve the grade of the products. Any improvements developed here will then be integrated into the existing milling process.

gram for uranium ores in San Juan County, Utah. The firm's principal property, the *Hideout* mine, has been proving too low grade, and an expected continuous channel of ore did not materialize. During the six-month period from October 31, 1957 to May 1, 1958, White Canyon shipped 21,144 tons of uranium ore, averaging about 0.235 percent U₃O₈. *Texas-Zinc Minerals Corporation*, operator of the *Happy Jack* mine in the White Canyon district, and the uranium mill at Mexican Hat, Utah, is a major stockholder of White Canyon.

WYOMING



Western Phosphates Inc. is planning a \$500,000 expansion of its production facilities at Garfield, Utah where the firm manufactures phosphate and ammonia fertilizers. The increase in capacity will probably result in a 10 percent increase in amount of phosphate rock used at the plant. The plant now uses about 12,000 tons of phosphate rock annually, mined in Utah, Idaho, and Wyoming by *San Francisco Chemical Company*. (*Western Phosphates* is jointly controlled by *Stauffer Chemical Company* and *Garfield Chemical Company*; *San Francisco Chemical* is an affiliate of *Stauffer*.) *Stauffer* and *San Francisco* are debating taking up option on the *Humphreys* phosphate deposit north of Vernal in Uintah County, where *San Francisco Chemical* has been making amenability tests on the ore.

The *Bullion Monarch Mining Company* has resumed exploration and development on two of its *Farmer John* claims in the Marysville area of Utah. A 500-foot adit is being driven to prospect one of these claims. Other claims in the area are leased by *Gullion to Vanadium Corporation of America*.

The government-owned uranium mill at Monticello, Utah, operated by the *National Lead Company*, is being converted to a single process using an alkaline leach followed by resin-in-pulp extraction. This process has been operating on a pilot plant scale, and this will be the first commercial application of the process in the treatment of uranium ores. Previously, the plant had used two separate processes in two separate plants: an acid leach resin-in-pulp plant for low lime, acid type ores and an alkaline leach plant for high lime ores.

Jolly Jack Uranium Company has completed negotiations for acquiring a full interest in a $\frac{1}{2}$ square mile mineral lease in the Deer Flats area of White Canyon mining district of Utah. The negotiations were started in October 1957 under the direction of a new management, and they complete the reorganization of the company's properties. Richard H. Hall is president.

White Canyon Mining Company is undertaking an extensive exploration pro-

Construction of the *Fremont Minerals Inc.* mill at Riverton, Wyoming is reported to be well ahead of schedule. It is slated to be processing ore by December 1. Scheduled merge of the *Susquehanna Corporation*, parent company of *Fremont Minerals Inc.*, with *Vitro Minerals Corporation* of Salt Lake City, Utah, has failed to materialize. *Vitro* had made an agreement with *Susquehanna* for the latter company to acquire *Vitro* through a stock purchase, but the Salt Lake City company announced that dissension within the *Susquehanna* board of directors created an unsatisfactory atmosphere, and the agreement was cancelled. *Vitro* was reported to be negotiating with the *Fremont* mill to have its ore processed under other arrangements.

Shoni Uranium Corporation's Bonanza mine in the Copper Mountain mining area 43 miles from Riverton, Wyoming is making good progress. August shipments totaled 771 tons of U₃O₈, averaging 0.39 percent, and shipments in September were expected to reach 3,000 tons. The ore is being mined from a pit about 100 feet deep. Some 246,000 yards of overburden were removed before mining began. The 50,000 feet of drilling completed on the East Gas Hills property revealed some small tonnage of submarginal ore, and a thin streak of good ore was found in several holes. The work was done under a DMEA contract.

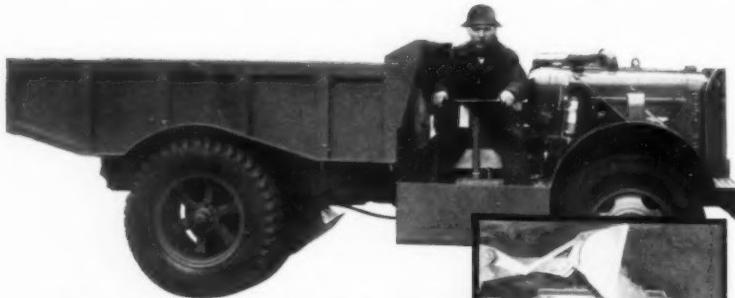
Lucky Mc Uranium Corporation has officially christened its \$10,000,000 mining and milling operation. In an open-house conducted by the company, 260 persons were shown through the plant, according to A. V. Quine, general manager. Mining operations are in process in four open pits, with an average of 23,000 cubic yards a day of overburden being removed. By the first of September, 5,000,000 cubic yards had been removed since the company began full-scale operations, at a cost of about \$2,000,000. *Lucky Mc* now employs 350 persons, and has a \$200,000 a month payroll. Its mill was granted a 100 tons per day increase under the new allocations.

Lou Kalman, president of *Western Steel Corporation*, has asked the City Council of Cheyenne, Wyoming, about the possibility of leasing or purchasing a tract of city-owned land for the site of a proposed \$200,000 iron ore processing plant. The plant would produce iron powder to be used in fabrication of gears, bushings, and other parts from ore of the magnetite deposits on Sybille Creek in Albany County.

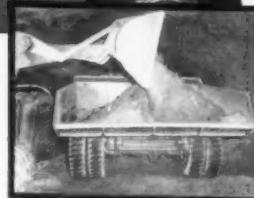
COLORADO

Colorado Beryllium Corporation has made its first shipment of beryl from its *Kenny Boy* 37 operation in the Crystal Mountain area southwest of Fort Collins, Colorado. The shipment went to the *Mineral Concentrates* mill at Loveland for processing. A similar shipment was then made to the *American Beryl* plant at Masonville. *Colorado Beryllium* con-

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STATEMENT OF OWNERSHIP

Statement required by the Act of August 24, 1912, as amended by the Acts of March 3, 1933, and July 2, 1946 (Title 39, United States Code, Section 233) showing the ownership, management, and circulation of MINING WORLD published monthly except in April when publication is semi-monthly at Bristol, Connecticut for October 1, 1958.

1. The names and address of the publisher, editor, managing editor, and business manager are: Publishers: Wm. B. Freeman, L. K. Smith, Miller Freeman, Jr., 500 Howard Street, San Francisco 5, California; Editor—George O. Argall, Jr., 500 Howard Street, San Francisco 5, California; Managing Editor—None; General Manager—M. F. Hollinger, 500 Howard Street, San Francisco 5, California; Business Manager—None.

2. The owners are: American Trade Journals, Inc., 500 Howard Street, San Francisco 5, California; Miller Freeman Publications, Incorporated, 500 Howard Street, San Francisco 5, California; Wm. B. Freeman, L. K. Smith, Miller Freeman, Jr., 500 Howard Street, San Francisco 5, California; W. E. Crosby, 71 Columbia Street, Seattle 4, Washington.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

MILLER FREEMAN, JR., Publisher

Sworn to and subscribed before me this 1st day of October, 1958.

(Seal)

Barbara M. Hampson, Notary of the Public
San Francisco, California

My commission expires February 18, 1962.

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Bear Creek Mining Fights for Nonesuch Shale Copper Lease on Michigan's Upper Peninsula

Kennecott Copper Corporation is making a determined effort to get a strong hold on copper properties in Michigan's Upper Peninsula almost midway between the very large ore bodies of White Pine Copper Company and American Metals Climax, Inc.

Leading the fight for Kennecott is C. H. Burgess, president of Bear Creek Mining Company, Kennecott's exploration subsidiary. And a fight it is, too, with Upper Peninsulans favoring and Lower Peninsula conservation groups opposed to the Michigan Conservation Commission granting Bear Creek mining leases on a section of the scenic Porcupine Mountains State Park. This wilderness area is in Ontonagon County and Bear Creek has applied for leases covering 933 acres along the southern shore of Lake Superior and 5,000 acres of adjoining lake bottom in 51 N., R. 44 W. Bear Creek applied for leases early this year, but they have not been approved by the Commission until public hearings have been held and evaluation studies made.

Opposition to mining leases in the State Park have been expressed by the Michigan United Conservation Clubs, Michigan Audubon Society, the Michigan Botanical Club, and other groups who feel that mining would spoil the unspoiled wilderness area.

The map shows location of the White Pine mine, The American-Climax exploration shaft, the Kennecott lease applications, and the approximate outcrop of the Nonesuch Shale.

The Nonesuch shale is the key to the area. At White Pine mine, more than 309,000,000 tons of ore averaging 1.1 percent copper have been developed in a 3- by 5-mile area. The mineralization occurs in Upper Keweenawan sandstones, siltstones, and shales. The ore is restricted to two important mineralized horizons. The topmost, upper shale, averages 3 to 5 feet in thickness and has an average grade over 1.25 percent copper. Three to five feet below it and separated by sandstone is the 7- to 8-foot thick parting shale assaying 1.2 percent copper. White Pine mining was predicated on the parting shale. The ore body is generally thought to be syngenetic with a probable copper source as the copper-bearing Keweenawan lava flows to the northeast. Chalcocite (Cu_2S) is the chief copper mineral with native copper and argentiferous bornite (Cu_3FeS_3), chalcopyrite ($CuFeS_2$), and covellite (CuS) being present. Ore localization for the area as a whole seems to be lithologic and strategic. White Pine started mining in 1953 and has operated since at a rate of 12,000 tons per day.

Late in 1957, American-Climax announced that it had developed, by drilling, 50,600,000 short tons of 1.52 percent copper and 54,400,000 short tons of 1.04 percent copper ore. Location of American-Climax's exploration and development shaft which was completed last year is shown. This shallow shaft and lateral development from it permit visual examination and inspection of the ore bed.

The Kennecott lease application area is believed particularly favorable by many geologists. The cupriferous zone has been

found cropping out near Lone Rock not far from the Lake in lease area. The Upper Shale bed is in place but some doubt exists as to the correlation of the Parting Shale. At White Pine mine hydrothermal transportation of copper from the White Pine fault increased mineralization. At Lone Rock a strong fault with a brecciated zone 500 feet wide cuts the Nonesuch shale. It may be a mineralizing channel.

Bear Creek believes that highest grade copper will be found off shore from Lone Rock. Bear Creek hopes to secure a lease for a least 50 years. The firm is also planning to fly equipment and drills into the area by helicopter. Under Lake exploration is planned from boats anchored off shore. Other boats will be used for transportation in and out of the lease area.



Exclusive world-wide licensing rights to the new electro-thermal process for single-step reduction of metallic oxides have been acquired by *Hydrometals Inc.* of Chicago, Illinois. The process reportedly makes possible economic production of many difficult to reduce metallic oxides. It is considered applicable to columbium, tantalum, boron, tungsten, vanadium, titanium, beryllium, zirconium, and other materials that now require costly, involved reducing processes. *Electro-Thermal Industries Inc.* is developer of the new process.

Silver City Mining and Processing Company of Toronto, Kansas is sinking a shaft and building a processing plant in order to recover rich water soluble potassium and magnesium salts which the firm has uncovered along with flake phlogopite mica.

The first arm of *Freeport Sulphur Company's* new floating sulphur mine near Grande Isle, Louisiana has been completed. The "Y"-shaped structure,

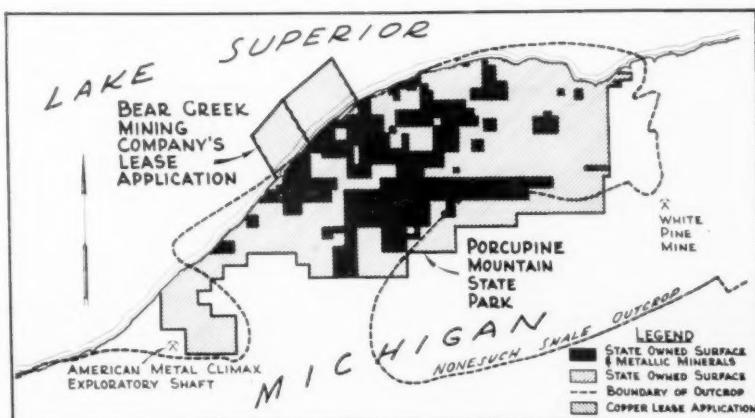
reported to be the first of its kind, is expected to be in full operation by 1960.

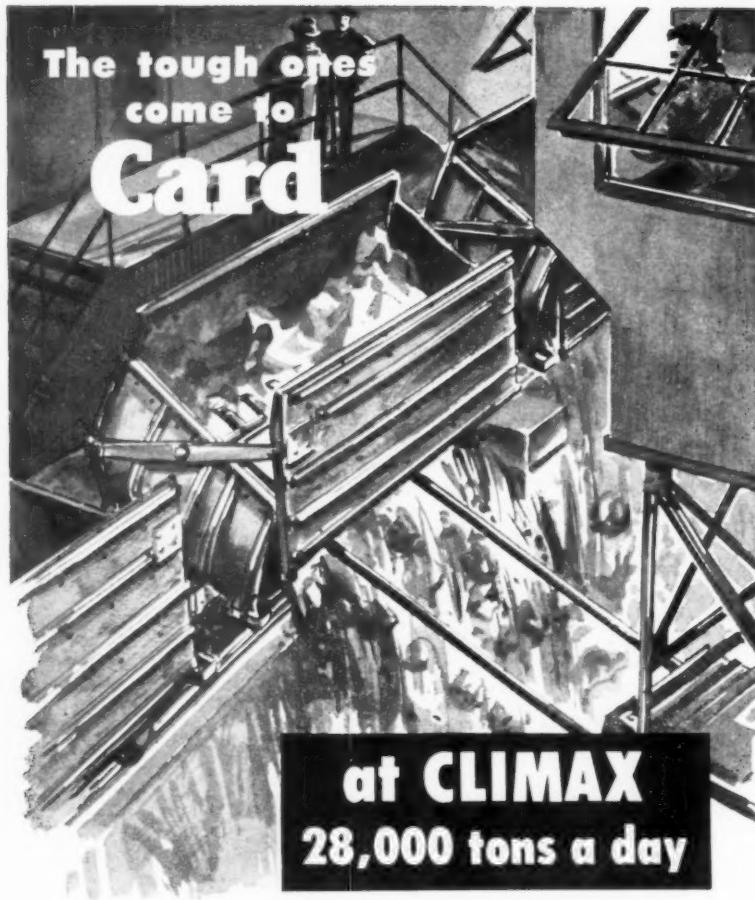
Reynolds Metal Company is expanding operations at its Jones Mills, Arkansas, and Lister Hill, Alabama, aluminum reduction plants. Production at the Arkansas plant is being raised from 73 to 83.5 percent of capacity, while the Alabama plant will increase annual output from 173,000 to 190,000 tons.

Rush Creek Mining and Exploration Company, Inc. of Yellville, Arkansas has almost completed its new 500-ton zinc processing plant at Rush, southeast of Yellville. Drilling and exploration of the field has been completed and the mill will be in operation about December 1. The district was a zinc producer during World War I and then abandoned. About 63 mines are said to exist in the area. Rush Creek Mining and Exploration plans to mine only four of these itself; the remainder are to be subleased at 6.0 percent royalty to independent mining companies. C. A. Boyd of *Boyd Mining Enterprises*, Yellville, Arkansas, is reported to have opened a new drift in the area and uncovered a large ore body. C. T. Black is president of Rush Creek; W. C. Barnett, vice president and treasurer, Garvin Fitton, secretary; C. C. Corbin, geologist and supervisor.

Southern Illinois Mining Company has rented the chemical laboratory of the *Rosiclare Lead and Fluorspar Mining Company* at Rosiclare, Illinois. All of the company's chemical and physical analyses of fluorspar will be done here under the direction of Gilbert Frayer. Southern Illinois Mining also rents Rosiclare's barge loading dock at Rosiclare.

A simplified refining process for converting uranium ore concentrate into gaseous uranium hexafluoride UF_6 is being installed in a 5,000-ton-per-year uranium processing plant at Metropolis, Illinois for *Allied Chemical Corporation*. The process uses a highly improved technique, known as fluidization, for performing chemical conversions. The prepared concentrate is fed into a fluid-bed reduction reactor where the ore reacts with hydrogen gas and is reduced to uranium dioxide. In a second reactor it reacts with hydrogen fluoride and is converted into uranium tetrafluoride. Finally, in the third reactor, it is fluorinated and converted into uranium hexafluoride. The gaseous UF_6 then goes to a distillation tower for further purification.





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CENTRAL AND EASTERN



American Zinc, Lead & Smelting Company reports business has been improving each month since April, with August much better than any other month. August was the first near-normal month for American Zinc rock products sales, too, earnings to date have been slightly above dividend payments. In addition to continuing a joint iron ore exploration program with Granite City Steel Company in the Bourbon area of Missouri, American Zinc plans to bring its Cog mine in Tennessee into full production late this year.

The General Services Administration is again taking application for domestic manganese purchases through December 31, 1958. The program terminates in 1961 or when 28,000,000 long dry ton units of manganese have been purchased, whichever occurs first. As of August 31, 1958, 8,034,175 long ton units of contained manganese remained to be bought. If deliveries continue at current rates, the program should end late next year or earlier.

Armco Steel Corporation has installed a Lurgi Company (Germany) 2,400-ton-per-day sintering plant at its operations in Ashland, Kentucky, for the agglomeration of iron ore fines and other raw materials. Engineered and constructed by Dravo Corporation, it is the first plant to be built and placed in operation by Dravo under a license granted by Lurgi. Three other plants are in various stages of construction by Dravo. One with a capacity of 2,000 tons per day is going through shakedown operations at McLoone Steel Corporation's operations at Trenton, Michigan. Two others with 15,000-ton-per-day capacity are nearing completion at Gary, Indiana and Saxonburg, Pennsylvania for U.S. Steel Corporation. The Ashland plant was built primarily to agglomerate iron ore from Labrador. It will also reclaim large stockpiles of flue dust and sludge which have accumulated during the past 16 years. These stockpiles are estimated to contain about 360,000 tons with an iron content of about 50 percent.

Tennessee Copper Company at Copperhill, Tennessee has started up its No. 1 acid plant again after a summer layoff to permit adjustment of the firm's acid inventory. During the shutdown, repairs were made to the bottoms of the chambers and other parts, such as flues and towers.

American Cyanamid Company's phosphate mines in Polk and Hillsborough counties of Florida have returned to full production. Mining was curtailed in April to reduce the company's inventory. A new phosphate kiln has now been placed in operation at the Brewster plant which doubles the firm's phosphate drying capacity.

The General Services Administration is calling for bids to upgrade substantial quantities of materials now in government stockpiles to ferromolybdenum, ferrovanadium, molybdate oxide, and tungsten carbide powder.

American Smelting and Refining Company has developed a new, continuous

process to produce zinc as a thin foil. The work was done at the firm's Central Research Laboratory at South Plainfield, New Jersey, and a pilot plant unit is now turning out developmental quantities of foil in sheets ranging from 0.005 to 0.001 inch in thickness and 26 inches wide. Asarco is now considering installation of a larger scale pilot unit at its zinc smelting plant in Corpus Christi, Texas.

The Defense Metals Information Center has been opened at Battelle Memorial Institute in Columbus, Ohio. The center will operate under the direction of the Assistant Secretary of Defense (Research and Engineering). It will collect and disseminate technical information on titanium, beryllium, refractory metals, high strength alloys for high temperature service, corrosion and oxidation resistant coatings and thermal protection systems. The Center has a broader scope than its predecessor, the Titanium Metallurgical Laboratory; this was needed because of the intensified effort in research in new special materials for increased performance in future weapons systems.

A field crew from Tennessee Copper Company recently began studies in the Gold Hill area near Salisbury, North Carolina to determine sites for drilling in an area which has been mined for gold and copper intermittently since 1799. Recently, some of the prospects in the Gold Hill area have been found to contain radioactivity, which is attributed to the presence of uranium ore.

The Carborundum Company has placed its newly expanded boron carbide manufacturing facilities in full operation at Niagara Falls, New York. The new plant uses many novel mineral dressing techniques and is supported by a new products laboratory which contributes to rigid quality control of boron carbide products in the new plant.

The Calloway-Mary copper mine of Tennessee Copper Company at Copperhill, Tennessee, was awarded a "Sentinel of Safety" in the 33rd National Safety Competition sponsored by the U. S. Bureau of Mines. This mine worked 219,085 man-hours without a lost-time injury, the best in its group of underground metal mines.

At the U. S. Bureau of Mines Electrotechnical Experiment Station at Norris, Tennessee, during fiscal year 1959, an attempt will be made to complete studies to produce zirconium boride directly from zircon and a boron compound. This will be followed by fabrication and evaluation of zirconium boride compacts for industrial applications. Studies also will be started on the nature of abrasion.



The Cleveland-Cliffs Iron Company has an agreement with Juneau County, Wisconsin to drill various areas in the county. Three University of Wisconsin men found these areas highly responsive magnetically which would indicate the presence of "some materials heavier than the general geologic formation in these areas." Drilling started during October with the use of core drills. Juneau County is located in the west central section of Wisconsin.

Lake Superior iron ore shipments as of October 1, 1958 totaled 39,783,517 tons, off 43 percent from the 69,523,900 tons in the 1957 period. Part of the decrease was attributed to the slow start in deliveries this year because of the recession earlier in the year; the season opened four to six weeks later in 1958. Total stocks of iron ore at furnace yards and docks in the United States at the end of August were nearly 53,500,000 tons, compared with 55,500,000 a year ago.

In reply to a suit by Reserve Mining Company to compel Mesabi Iron Company to arbitrate the firms' differences, Mesabi has replied that Reserve owes

Mesabi \$16,166,667 in rent. Reserve is currently mining about 15,000,000 tons of taconite annually from deposits in northern Minnesota leased from Mesabi. The output goes to Armcro Steel and Republic Steel, co-owners of Reserve. Mesabi charges that Reserve has both understated income and overstated expenses, reporting net losses instead of profit.

Pickands Mather & Co. is closing its Zenith mine in Ely, Minnesota which first began operations in 1892. Conditions in the mining industry do not make continued operation feasible, according to company spokesmen. The mine has been idle for several months. Through 1957, it had been the second in tonnage on the Vermillion Range.

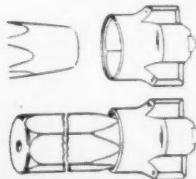
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The type TS Tee Cee Liddicoat (no resharpening) bit has a completely new short taper socket connection. Within the socket of the bit is a brass shim. The socket, which is completely forged, is tapered to correspond to the taper placed on the drill rod. The connection assures an absolute attachment to the rod, and yet permits easy removal.



**Illustrated is the popular
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7/8" to 1½"
Forged for Toughness
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precipitates—NORTHWEST

Northwest Miners To Meet In Spokane Dec. 4 and 5

The Northwest Mining Association is preparing to welcome one of its largest crowds at its 64th annual convention December 5 and 6 in Spokane, Washington.

Arrangements are being made under the direction of E. K. Barnes, president, and William D. Nesbett, general chairman of the convention. Mr. Barnes recently retired as chairman of the board of the First National Bank in Spokane and is a director of several mining firms. Mr. Nesbett is district manager for Allis-Chalmers Manufacturing Company.

Convention vice chairman is Fred J. Weiler, Washington state supervisor for the United States Bureau of Land Management. Program chairman is E. C. Stephens, geologist in charge of the Anaconda Company's Spokane exploration office, and Rollin Farmin, Wallace, Idaho, is vice chairman.

Program committee members are J. B. Haffner, A. E. Weissborn, Russell Chadwick, Verne Fryklund, John Cole, W. H. McNair, and Eskil Anderson of Spokane, and C. H. Mitchell of Vancouver, British Columbia.

Other committee chairmen: Frank N. Marr, financial; David E. Watson, publicity; Mr. Nesbett, entertainment; Hamilton C. Owen, registrations; Karl W. Jasper, nominating, tickets and badges; Wray D. Farmin, resolutions; Mr. Haffner, life membership; A. R. Patterson, Republic, Washington, state legislature.

Members of the resolutions committee are: Robert N. Hardy Jr., Jens Jensen, Elmer E. Johnston and Eustace LeMaster, all Spokane; Wallace G. Woolf, Charles E. Schwab and Archie McKinley, Kellogg, Idaho; J. C. Kieffer and Charles E. Horning, Wallace, Idaho; E. H. Lovitt, Wenatchee, Washington; John Currie, Metaline Falls, Washington, and R. Dwyer, Salt Lake City, Utah.



Sinking of a new 1,000-foot vertical shaft was started recently at the silver-lead mine of *Conjecture Mines, Inc.*, in the Lakeview District of Bonner County,

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6 sizes—flows from 1 to 90 gpm.



Idaho. The three-compartment shaft is being driven on a three-shift, six-day week basis by a 21-man crew. A 75-foot steel headframe, a concrete block hoist house, a transformer station, and a 120-by 40-foot timber shed are new additions to camp structures. The shaft site is 500 feet down the canyon from the old inclined shaft and a working level at the 624-foot depth will connect with the bottom 700-foot level workings of the old shaft. The project is being carried out by *Federal Uranium Corporation* of Salt Lake City and will increase that firm's investment at the property to about \$1,000,000. Donald E. Maier, Spokane, heads *Conjecture*. Ralph W. Neyman, Salt Lake City, is president of *Federal*. Walter N. Campbell is mine superintendent.

A major exploration program for euxenite, columbian, tantalum, monazite, zircon, and ilmenite has been initiated along Bear Valley Creek Valley County, Idaho, by *Rare Metals Corporation of America*, an affiliate of *El Paso Natural Gas Company*, with headquarters in Salt Lake City.

Soil sampling of a cobalt prospect adjacent to the *Blackbird* cobalt mine in Lemhi County, Idaho was undertaken by *Capital-Seaboard Corporation* following the uncovering of promising mineralization by bulldozing. Diamond drilling is planned for next spring. Fifteen claims are being explored under a \$62,500 contract with the *Defense Minerals Exploration Administration*. Joseph H. Corbin of Wichita Falls, Texas, is company president.

In the Mullan area of Shoshone County, Idaho, *Hecla* and *Bunker Hill* mining companies have undertaken to probe ground of *Cortez Silver Lead Mines* lying east of the *Lucky Friday* silver-lead mine. Plans included driving of a diamond drill hole 2,000 feet or more in length (a new district record) from the 2,000-foot deep workings of *Silver Mountain Lead Mines*. L. J. Randall, Wallace, heads the operating *Hecla* firm.

The elemental phosphorus plant of *Monsanto Chemical Company* at Soda Springs, Idaho again is operating at two-furnace capacity following a six-month curtailment. R. R. Rumer is plant manager.

Clearwater Mines, Inc. is building a new boarding house and rehabilitating mine workings at its *Niagara Creek* pro-

perties in south-western Shoshone County, Idaho. Diamond drilling is planned from a 2,100-foot exploration tunnel which exposed values in copper, silver, and gold.

Articles of incorporation for *Modern Metals, Inc.*, Salmon, Idaho, have been filed by Gerald I. Hurley, Wallace R. Oref, and P. N. Shockley of Salmon, and Nolan E. McDougal, David L. Gossett, and T. S. Henderson, all of San Diego, California. Capitalization was listed at \$500,000.

Triumph Mining Company's 300-ton selective flotation concentrator in Blaine County, Idaho's Warm Springs district is being dismantled for shipment to a mine 80 miles from Havana, Cuba. Antonio Estemez is the Cuban engineer in charge. The *Triumph* mine and mill were shut down a year ago.

Nuclear Fuels and Rare Metals Corporation has taken over *Idaho Uranium Company* and *Salmon Uranium and Thorium Company* in a merger. The surviving firm was organized to develop thorium deposits in the Lemhi Pass area of Idaho.

Echo Bay Silver-Lead Mining Company has begun a survey of its mining claims southeast of Bayview, Kootenai County, Idaho. A. A. Amondson of Wallace, Idaho, is secretary, and E. C. Schaeffer, Bayview, president.

Porter Brothers' columbium-tantalum-monazite dredging operation is the only active mining operation in Valley County, Idaho, whereas a few years ago the county was the nation's leading antimony producer and also yielded substantial amounts of gold, tungsten, and mercury.



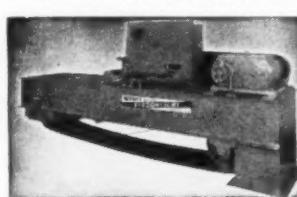
Miller-Smith Company of Spokane, Washington is reported to be doing exploratory drilling for *Sunshine Mining Company* in the area around Cooke City, Montana.

An initial car of copper concentrates has been shipped from the *Hidden Treasure* mine near Clinton, Wallace Creek mining district, Missoula County, Montana by *Hera Exploration Company* of Renton, Washington. The product from

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NORTHWEST

the firm's new concentrator went to the Anaconda smelter. The Washington firm, which started work in the area two years ago, also is renovating the old Cape Nome shaft to reach copper-silver-gold ore reportedly left behind in 1912. The shaft work has been on a three-shift basis. Diesel-electric equipment has been installed.

The Brazil Creek Bentonite Company was incorporated recently to develop a bentonite deposit, located about 15 miles west of Glasgow, Montana. Incorporators are Robert Hansen, Robert Hurley, and Leslie Hanson. An open-pit operation is planned.

All major buildings, including the mill, were burned to the ground recently at the historic Granite Bi-Metallic mine located in the ghost town of Granite, four miles west of Philipsburg, Montana. The Trout Mining Division of the American Machine and Metals Corporation had started to develop and reopen the mine on a limited scale. Three men who were underground at the time of the fire escaped without injury. Roy McLeod, manager of the Trout Division, estimated the damage at around \$50,000. This historic mine produced over \$50,000,000 in silver ore from 1882 through 1895.

Iron ore mined from the Running Wolf district, south of Stanford, Montana by Young-Montana Company is going to a Pittsburgh steel company. An iron ore deposit on Carter Creek east of Dillon is under development by Minerals Engineering Company, and 4,000 tons are to be mined for large-scale testing. Rotary drilling has been undertaken to outline the ore body. The new Torkhammer In-the-hole hammer drill is being used. J. L. Robinson is general manager of Minerals Engineering.

Several mining firms have been incorporated in Montana recently: Rhea Minerals at Missoula, by Lee and Marguerite Reveal of Collins and Arthur Charboneau of Missoula; Lakeview Company, a mining, smelting, and refining firm, by Ruth I. Sullivan and R. J. and Carol K. Boyd, all of Anaconda; and Continental Rare Metals Inc. of Hamilton, by W. T. Boone, Russell W. Smith, Karl R. Karlberg, Valborg M. Huffman, and Martha Alsteens, all of Missoula.



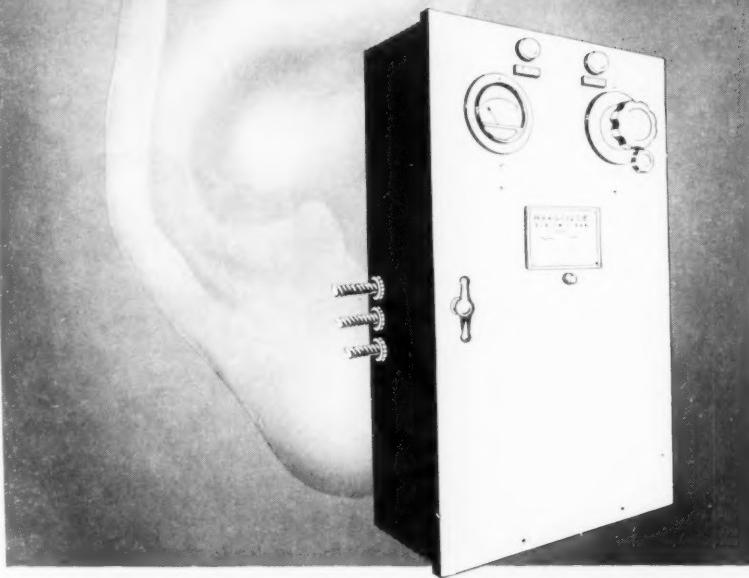
The Bear Creek uranium property in Crook County, Oregon has been leased by Leonard Lundgren & Associates of Bend. Exploration is to be directed by geologist James Barlow.

A 96-foot steel headframe has been completed at the White King uranium mine, Lake County, Oregon, and a 150-horsepower, double-drum hoist installed for sinking the three-compartment shaft 700 feet. Lakeview Mining Company is the operator.

Moe Platt and associates have been doing exploration at the leased Zinc mine on the South Umpqua River, Douglas County, Oregon.

Boaz Mining Company is driving a 1,400-foot adit at the Buffalo gold mine in Grant County, Oregon to gain 230 feet of depth on ore bodies. James P. Jackson is in charge of operations.

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Users report 10 to 15% INCREASE in their GRINDING MILL CAPACITY

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"Approximately 25% gain in capacity."

"Helps prevent plug-ups."

"Maintains uniform mill load. Estimated gain in capacity 10%."

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"'Electric Ear' is helpful when inexperienced grinders are learning to operate the mills."

"Eliminates human element in mill feed level."

"Saving per year—\$10,000.00."

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MINING WORLD

NORTHWEST

In Josephine County, Oregon, R. C. Hanford is doing underground exploration at the leased *Daisy* gold mine; Earl Young is working the *Humdinger* gold mine intermittently; and Quentin Stone is working the *Reno* gold mine.

In Jackson County, Oregon's Gold Hill District, Frank Gelhaus of Rogue River is mining and milling gold ore from the *Warner* mine.

A mercury deposit on Angel Peak in western Lake County, Oregon, is being mined by *Western Minerals, Inc.* of Lakeview. The firm has erected a 30-ton Lacey furnace.



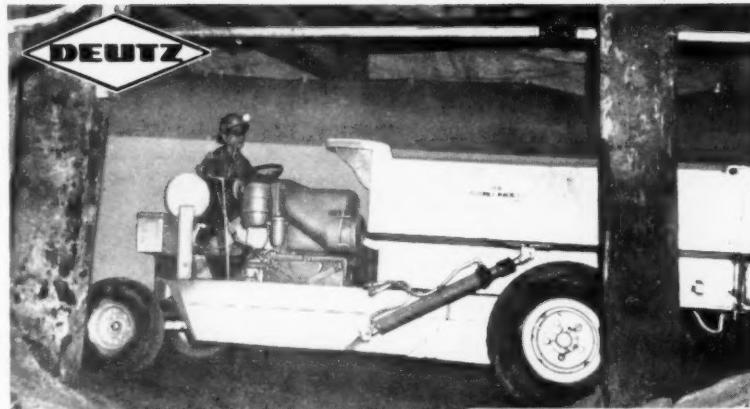
Regular truck shipments of uranium ore are being made by *Silver Buckle Mining Company* from the Spokane Indian Reservation, Stevens County, Washington, to *Daven Mining Company's* processing plant at Ford, Washington. The ore is being mined by open-pit methods from a deposit drilled out by *Northwest Uranium Mines, Inc.* Silver Buckle has a contract to ship 25,000 tons of ore to the Ford plant by July 1. Dr. F. E. Scott, Wallace, Idaho, is company president.

A 600-foot adit has been started at the open-pit uranium mine of *Daybreak Uranium, Inc.*, in the Mount Spokane District, northern Spokane County, Washington. The adit will open an ore zone outlined in a 47-hole drilling program. *Addy Development Company*, headed by Frank Birch, is doing the work under a profit-sharing plan. Daybreak abandoned a trackless tunneling operation at the 100-foot point. The firm has exposed a new autunite zone on an adjoining tract by bulldozing and is planning to drill the showing. At its *Louley* lease in the Spokane Indian Reservation, Stevens County, the firm is in the second phase of a \$29,476 drilling project approved by the *Defense Minerals Exploration Administration*. Kae H. Sowers, Opportunity, is secretary.

Mudhole Exploration Company has shipped 350 tons of autunite ore from its property in the Mount Spokane District, Spokane County, Washington. The shipment averaged nearly 0.30 percent uranium oxide. Mining operations are by bulldozer and loader. David Berry is geologist in charge. Ralph Umbreit, Spokane, is vice president.

A 340-ton shipment of uranium ore has been made from *North Star Uranium's Lehmbecker lease* in the Mount Spokane District, Spokane County, Washington, by sublesses *Frazer & West*. North Star has been doing some exploratory drilling in the Spokane Indian Reservation. John F. Campbell, Spokane, is president.

American Zinc, Lead and Smelting Company is sinking an offset shaft in its *Grandview* mine, Metaline District, Pend Oreille County, Washington, to get 300 feet of additional depth on the ore zone. The new shaft is about 3,000 feet from the main working shaft. Mining operations are on a five-day week, with a crew of 50. John W. Currie is resident manager.



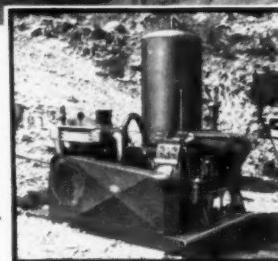
**Utah Mining Truck Manufacturer Picks
AIRCOOLED
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for its Shuttle Buggies**

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PARTIAL SPECIFICATIONS TABLE

MODEL	BHP	RPM
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F 2 L 712	20/24	2000/2300
F 3 L 712	30/39	2000/2300
F 4 L 712	40/52	2000/2300
F 6 L 712	60/78	2000/2300
A 2 L 514	28	1800
A 3 L 514	42	1800
A 4 L 514	56/72	1800/2000
A 6 L 514	84/110	1800/2000
A 8 L 614	112/145	1800/2000
A12 L 614	170/220	1800/2000

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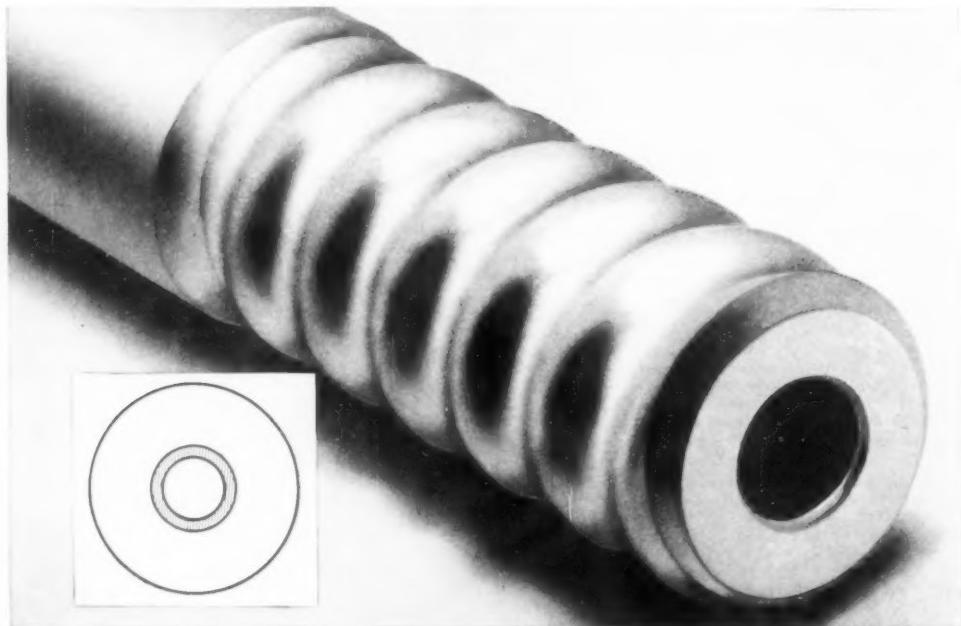
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INTERNATIONAL NEWS



EUROPE

PORTUGAL—Three German firms and a Belgian syndicate have formed a consortium to bid on construction of a steel plant on the Tejo River of Portugal. The German firms involved are *Demag*, *Rheinstahl - Industrie - Planung Gmbh*, and *Carl Still*; the Belgian group is not known at this writing. Portugal has been considering this development since 1955 but internal agreements over the site of the plant postponed work. Now a site has been agreed upon near Seixal, south of Lisbon. Initial capacity of the plant will be 250,000 tons of ingot steel annually. Ores from the high-grade *Orada* and *Cercal* deposits in southern Portugal and the well known *Moncorvo* deposits will supply the plant. The project calls for construction of wharfage space for ore, coke, and coal; a coking plant; blast furnaces with an annual capacity of 210,000 tons; a steel plant with one 35-ton electric arc furnace and one 30-ton oxygen-blown converter; a sintering plant with 700,800 tons daily capacity; and a rolling mill.

YUGOSLAVIA—Expansion of the *Majdanpek* copper mines is about to get under way after a year's delay during which time the government raised \$18,000,000 for purchase of heavy equipment. This was in addition to the \$40,000,000 to be invested by French and Belgian interests. (The French companies involved in this project have combined under the name of *Compadec*.) The expansion is expected to increase production from 30,000 tons to 55,000 tons annually. Exploration has indicated that a potential reserve of 290,000,000 tons of copper ore is available. The sulphur gases from the copper smelter will be used to produce sulphuric acid which, in turn, will be used in production of 570,000 tons of superphosphates annually. Meanwhile, the government has delayed development of the aluminum project at Titograd in Montenegro. This plant was to produce 100,000 tons of aluminum annually. Its development was to be financed by a \$175,000,000 loan from the Soviet Union and East Germany, but the loan was suspended in May.

GREAT BRITAIN—The *Dowty Group* has formed a new Canadian subsidiary, *Dowty Mining*, to enter the Canadian mining field. In Britain, *Dowty Mining Developments* has been established to take over the research and development of new engineering products for use in mining.

ITALY—A bill covering development of off-shore mining resources is to be resubmitted to the legislature as soon as possible. A similar bill was defeated by the last legislature, and the Minister of Industry, Senator Bo, is reported to be considering a revised draft.

GREAT BRITAIN—The United Nations conference on lead and zinc held in London recently produced some suggestions which will be submitted to member governments for consideration. These suggestions included: general level of exports of ores, concentrates, and metals in both lead and zinc should be reduced for a temporary one-year period; machinery should be set up for

prompt review in which both consuming and producing interests would have adequate representation; a possible reduction in world mine and smelter output; and a study group should be appointed to consider long-term problems of lead and zinc.

SPAIN—A new cinnabar operation is about ready to go into production. *Minas Tonin* near Oviedo in northern Spain is making preparations for a daily output of 10 tons of ore.

UNITED KINGDOM—Initial shipments of copper from *St. Patrick Mining Company Ltd.*'s mine near Avoca, County Wicklow, Eire, are scheduled to be made to Britain and Sweden within the next few weeks. Approximately 100,000 tons of ore have been stockpiled at Avoca. Shipment will be made through Arklow, located about six miles from the mine. *St. Patrick Mining Company* is a subsidiary of *Mogul Mining Corporation*.

RUSSIA—A new iron and steel works, with projected capacity of 5,000,000 metric tons of pig iron and 4,000,000 tons of raw steel annually, is under construction at Kutzniets in western Siberia, according to recent reports. The plant will utilize five blast furnaces, with 1,513 cubic meters capacity; six open hearth furnaces with 500-ton capacity; and four furnaces with 250-ton capacity. It will cover a 2½-square-mile area. Open hearth charge will consist of 70 percent pig iron and 30 percent combined CaO/scrap/ore agglomerate. Some scrap will be used by the blast furnaces. Production is expected to begin during the next few years.

The *Rourkela* and *Bhulai* plants will start production by the end of this year, and attain full capacity by 1959. The *Durgapur* plant will go into production by the end of 1959, and achieve full capacity a year later. *Rourkela*'s capacity is to be 720,000 tons, *Bhilai* 770,000 tons, and *Durgapur* 790,000 tons. In addition, the *Tata Iron and Steel Company* is expanding its plant capacity to 1,500,000 tons; *Indian Iron & Steel Company* to 800,000 tons; and *Mysore Iron & Steel Works* to 100,000 tons. The production programs of the different plants have been so coordinated that the increased output will be spread over all varieties and categories of steel. Thus India is expected to be self supporting and to save about Rupees 150 crores per year in foreign exchange. Her production can help to finance two 1,000,000-ton steel plants every five years.

MALAYA—*Malayan Tin Dredging Ltd.* is reported to be planning to acquire *Kramat Pulai Ltd.*, a much smaller company, because Kramat is in the process of obtaining a property lying adjacent to Malayan Tin's ground. These days when the cost of buying or dismantling, transferring, and re-erecting a dredge is so high, it is an advantage to move an existing dredge to a fresh area merely by traveling across any intervening ground. With the acquisition of Kramat, the company could do this, and also increase the dredging life of its operation by Kramat's five-years reserves.

BURMA—A group of stockholders in *Mawchi Mines Ltd.* have formed a committee and have succeeded in unseating the directors of the firm. The new chairman is Lt. Gen. Sir Ernest Wood. Behind this action is the fact that Mawchi Mines has recently received £450,000 from the Burmese government under the Joint Venture Arrangement. With these funds in hand, there arose difference of opinion over what should be done with the money. The shareholders' committee contended that the rebel forces in the

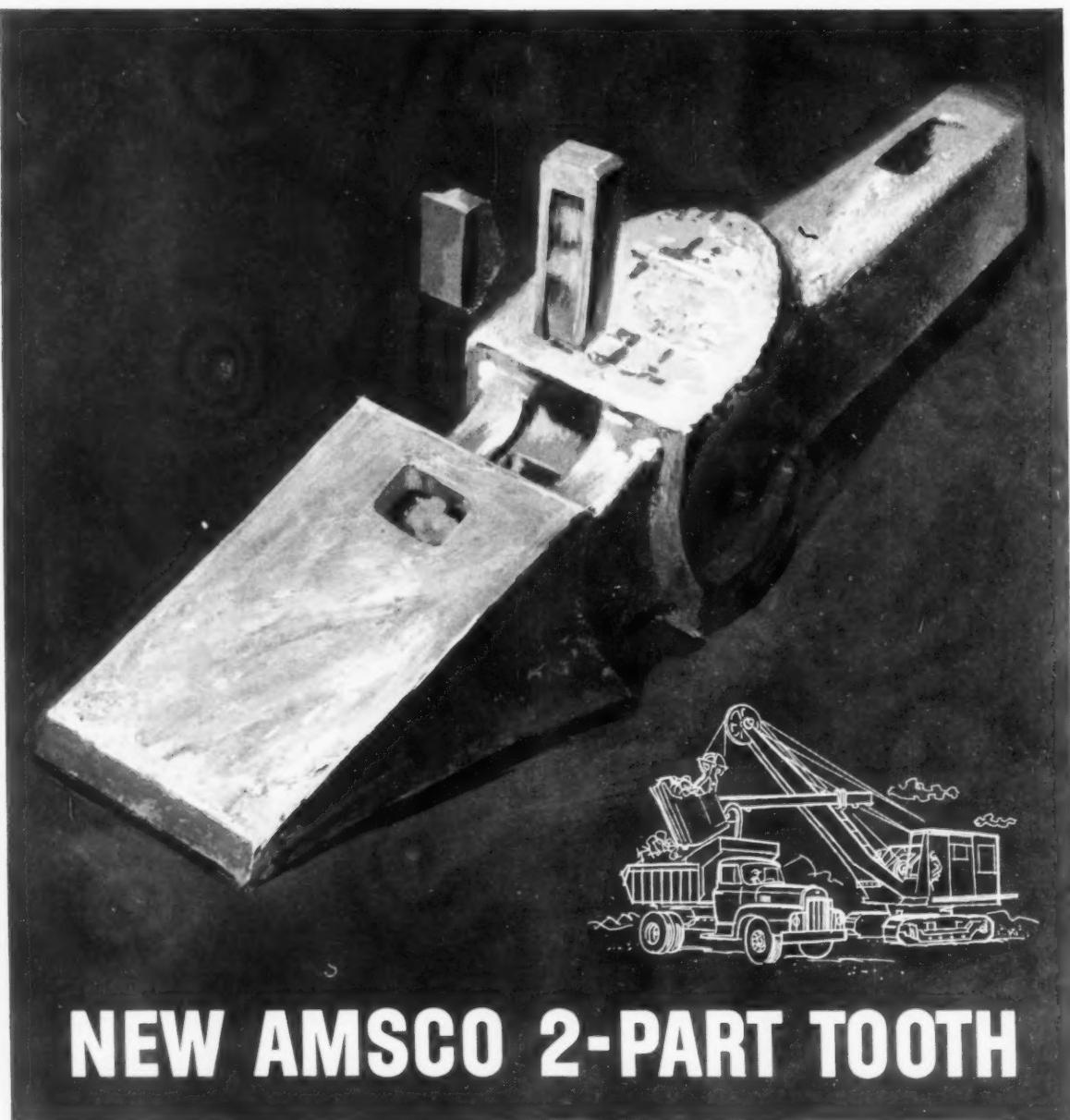


INDIA—India's new steel projects are moving into final stages of construction.



Russian Open-Pit Iron Ore Mine

Modern equipment loading iron ore (magnetite) at the Magnitogorsk Metallurgical Plant in the southern Urals Mountains of Russia. This is one of two pits that supply high-grade ore to eight blast furnaces at the steel mill a few kilometers from the pit. Production in 1955 was 12,190,000 metric tons of 50.5 percent iron ore. Reserves are estimated at 300,000,000 tons. Ore and waste is drilled with churn drills, blasted and loaded into side dump cars with the electric shovel. Note the twin sheaves on this modern shovel. The locomotive is a battery-trolley unit. Note the wooden trolley line poles. Also the little clean up done on the benches, but a rough road has been bulldozed at the lower right.



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mine area are stronger than the ones employed by the government. They are anxious, therefore, that this money be used in the interest of note as well as shareholders, instead of "dwindling it away on costly administration and other expenditures" in London and Burma. The mine has about eight years of proved ore reserves.

INDIA—For a brief period in September the government made a concession to exporters of manganese ore. The government permitted exports of manganese ore on an ad hoc basis against the 1957-1958 quota provided it was proved satisfactorily that such shipments were covered by firm foreign contracts concluded prior to July 1, 1958. Only ores lying in or raised to ports on or before June 30th, 1958 were covered by this special order.

JAPAN—An official of the *Ministry of International Trade and Industry* has assured Malaya that it would remain Japan's principal supplier of tin despite reports of Russian tin dumping on the world market. Japan had purchased \$300,000 worth of tin under contract recently, but this reportedly was stipulated in the Russo-Japanese Treaty signed in Moscow last December. On the other hand, Japan bought \$100,000,000 worth of Malayan tin in the first six months of this year. Under a so-called automatic approval system, however, Japanese firms can purchase tin from any country without government restriction and if Japanese firms decided to buy a great quantity of Russian tin, the government could not stop them, he said.

BURMA—In the Tavoy district, mine owners are searching for new tin areas, and trying to increase output from their known tin deposits. Tin exports for the first six months of this year increased by 322 tons. This figures could have been higher because mine operators are merchandizing their operations, but they are also encountering great difficulties and long delays, and, in some instances, refusal by government authorities to issue the necessary import licenses and release the necessary foreign exchange for spare parts for the machinery used. In some cases, machines have been idle for want of a small replacement part. In the Mergui district the *Tavoy Tin Dredging Corporation* has closed down its dredge at Theindaw. There are now no dredges working in the Mergui district.

PAKISTAN—The *Krupp-Renn* pilot at Rheinhausen in West Germany has successfully produced iron out of Pakistan's iron ore. It is estimated that Kalabagh from which the ore came, and the adjoining areas of Mianwali district, contain 100,000,000 tons of iron ore. Further prospecting is expected to reveal more. This ore will be used at the Multan steel plant to be built shortly. The Central Cabinet had approved construction of the plant but had allowed two months for the Ministry of Industries to submit alternative proposals for the type of process to be used. It is now probable that the new process to be installed will be the Krupp-Renn.

MALAYA—Because of the quota reduction on tin output, *Pacific Tin Consolidated Corporation* is not operating its No. 3 dredge at Kampar. Its quota is being grouped for the benefit of dredges No. 2 and No. 5, and the operating time of these latter two dredges will also be restricted. Dredge No. 8, which has

been under reconstruction, is about ready to go into operation.



AFRICA

LIBERIA—The *Exploration, Mining & Study Company* has obtained a 70-year iron ore concession from the Liberian government for a 300-square-mile territory east of Monrovia. Opening of the deposits will necessitate the building of a railway and special harbor installations. The firm is a subsidiary of the West

German companies of *August Thyssen* steel works and *Dortmund-Hörde & Rheinische-Stahlwerke*.

GHANA—Complaints that foreign mining companies operating in Ghana are paying very small fees and royalties has caused the Ghana government to set up a commission of inquiry. The general manager of the Ghana Chamber of Mines, Colonel C. H. Bean, has suggested to the Commission that a Concessionary Leases Board should be established to control the entire management of the concessionary rights of traditional owners of mineral rights. The Commission has held public hearings in the Ashanti region, as well as in other parts of the Southern Region, and Colonel Bean has proposed that rents on concessions might

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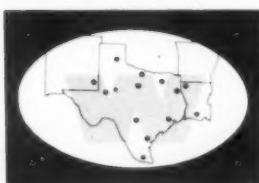
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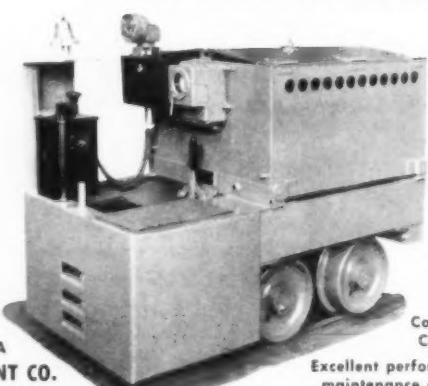


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be assessed according to the size of the claim area, its location, and the type of rights required.

NIGERIA—A tin ore occurrence has been discovered in a mineralized dike on the *Odufi* leases in which *United Tin Areas of Nigeria* holds a two-thirds interest, and *Ribon Valley (Nigeria) Tin-fields* holds a one-third. This occurrence is not alluvial as are other areas and is being tested for its immediate potentialities by diamond drilling. Production in a small way has also been started by open pit mining ore containing about 2% percent cassiterite.

UNION OF SOUTH AFRICA—*Hartbeesfontein Gold Mining Company* reports it has intersected the Vaal Reef in its No. 2A Subvertical Shaft at a depth of 6,256 feet. Gold values average 195 inch-dwts, and uranium oxide values about 17.98 inch-pounds. These are the first real disclosures from the deeper section of the mine which will be opened up from that shaft and from No. 3 located about 3,500 feet eastward. The No. 2A will be completed to 6,500 feet and the No. 3 to 5,500 feet. In the No. 1 shaft, completed to a final depth of 3,041 feet, the Vaal Reef was intersected at 2,861 feet with values of 185 inch-dwts. All real development so far advanced has been in the area of this shaft which is in the shallow section of the mine. These workings have been connected with the No. 2 Vertical Shaft, completed to 3,297 feet, by a twin-transfer haulage at a depth of 3,096 feet; this facilitates the hoisting of ore in this shaft.

FEDERATION OF RHODESIA & NYASALAND—One of the side effects of the Rhodesian Copperbelt strike is the fact that the official opening of the *Ndola* copper refinery, originally scheduled for September 1958, has been postponed indefinitely. The refinery has already gone into operation, however.

UNION OF SOUTH AFRICA—*Lorraine Gold Mines Ltd.*, is absorbing the *Riebeek Gold Mining Company*. Upon completion of reorganization, Lorraine will have authorized and issued capital of 20,000,000 and 12,290,676 shares of 10 shillings. The present capacity of the reduction plant is 75,000 tons a month which will treat ore from the southern Lorraine section, and, in the near future, higher grade ore from the northern Riebeek section; later, ore will come from the No. 1 Riebeek shaft area. When Riebeek ore becomes available, the yield, which has been 3,952 dwts a ton, will undoubtedly improve. Development on reef is reported to have been initiated in the northern Riebeek section.

FEDERATION OF RHODESIA & NYASALAND—In the quarter ended June 30, 1958, *Roman Antelope Copper Mines Ltd.*, produced 19,716 long tons of copper, bringing the year's total for the firm to 79,931 long tons, compared with 86,294 long tons in the previous year. Production by *Mufudira Copper Mines Ltd.*, for the last quarter (June 1958) was 23,508 long tons, bringing the year's total to 92,904 long tons, compared with 99,793 in 1957. *Chibuluma Mines Ltd.*, produced 5,237 long tons in the June quarter, bringing its annual total to 27,177 long tons, compared with 14,391 in 1957.

UGANDA—*Kilembe Mines* is now milling about 45,000 tons of copper-cobalt ore per month, derived from open-pit and underground operations at Kilembe. Copper concentrate obtained by

flotation is shipped to Jinja by rail. There it is electrolytically smelted and then converted to blister copper. A cobalt-bearing pyrite concentrate is also produced, but is being stockpiled at the mine pending an improvement in cobalt price. Copper production is about 1,000 long tons of blister copper per month.

TANGANYIKA—Mpanda mine of *Uruuru Minerals* is currently milling about 30,000 tons of lead-copper ore per month, containing about 2 percent lead and 0.5 percent copper. Heavy media separation rejects 55 percent and the remainder goes to flotation with a grade of 4 percent lead and 1 percent copper, from which 1,200 tons of con-

centrate is produced per month containing 42 percent lead and 11 percent copper. The latter is shipped to Belgium for further treatment. *Anglo American Corporation of South Africa* has a team of field engineers and geologists investigating the district around Mpanda.

TUNISIA—Discovery of a mercury deposit near Tabarka has been reported. No details are available except that production is expected to start soon.

KENYA—The United Kingdom Atomic Energy Authority, jointly with *Hunting (Geophysics) Ltd.*, is undertaking a radiometric survey of about 4,000 square miles of ground in the coastal belt in the Mackinnon Road area.

Nchanga Copper's New Chingola Open Pit



Stripping on Schedule as First Ore Mined



Nchanga Consolidated Copper Mines, Ltd. is making rapid progress in developing its second open pit copper mine in Northern Rhodesia's Copperbelt. The picture above gives a dramatic view of the small deep pit where stripping was started in April 1957. By August 1, 1958 when the picture was taken the pit was 195 feet deep and 1,000 by 1,000 feet in area from excavation of 5,867,000 tons of overburden and 93,236 tons of ore. The bottom picture shows the character of the bank which has been soft enough to dig without any regular drilling and blasting pattern. There have been some hard ribs and boulders which the shovel sets aside for plugging and blasting. This pit and the nearby Nchanga open pit are being developed to correlate mining of near surface ore with underground mining and to balance ore production and extend the life of the deposit. The 150-B Bucyrus-Erie electric shovel loading the 22 ton Euclid Diesel trucks in the bottom of the pit is one of three originally purchased for initial Nchanga stripping. It subsequently was moved to Chingola as were the Euclid trucks. A Caterpillar D8 bulldozer is used for shovel clean up and road building. Ultimate size of the pit will be 2,600 feet long, 1,500 feet wide, and 280 feet deep. Nchanga is managed by the Anglo American Corporation of South Africa, Ltd. which also acts as consulting engineers to plan and lay out the open pits.



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INTERNATIONAL



OCEANIA

QUEENSLAND—Mount Isa Mines Ltd. at Mount Isa is proceeding with considerable additions to its copper smelter to cope with further production increases in mining of copper ore. A second reverberatory furnace is being built; a 30- by 13-foot converter will be installed (present converters are 20 by 10) and a Cottrell electrostatic precipitation unit is being built to treat smoke from the roasters and reverberatories. Blister copper output is now running at the monthly rate of 3,300 to 3,400 tons from about 80,000 tons of ore mined. The copper refinery at Townsville (*Copper Refineries Pty. Ltd.*) is now expected to commence operating about the third quarter of 1959. Initial capacity will be 30,000 tons of wirebars. This will be expanded to 60,000 tons.

REPUBLIC OF THE PHILIPPINES—*Lepanto Consolidated Mining Company* has announced the completion of its low level drain tunnel in the *Lepanto* mine in Mankayan, Mountain Province. The 900 level drain tunnel was driven from the surface to meet a drift driven outward from the 1060 production shaft. The connection was made with "little error." Distance from surface to shaft is almost exactly 1,800 meters. The drain tunnel had been started in 1955, but work was suspended after only 140 meters had been driven because the men and equipment were more urgently needed elsewhere in the mine. Work was resumed in late 1956. In September 1957, the second face was opened driving outward from the production shaft until the two faces were connected this September. Meanwhile, in August the firm treated 38,584 tons of ore, to recover 4,449 tons of concentrates containing 2,464,500 pounds of copper and 3,765 ounces gold.

SARAWAK—*Semantan Bauxite Ltd.* has made its first shipment to Japan under its contract. The shipment totaled 35,000 tons; a load of 6,000 tons recently went to Formosa (see *Mining World*, July 1958, page 84). The mining is conducted by a joint Canadian-Swiss-Japanese group.

QUEENSLAND—Tin returns from *Tableland Tin Dredging N.L.* at Mount Garnet have improved in recent months. Output for two months has totaled 142 tons, from 600,000 cubic yards of ground dredged. Power from the Tully Falls hydroelectric project is now assisting in reduction of operating costs. Meanwhile, *Ravenshoe Tin Dredging Ltd.* is only obtaining yields of 20 to 25 tons of concentrates per month from 200,000 cubic yards dredged.

REPUBLIC OF THE PHILIPPINES—*Itogon-Suyoc Mines* is stepping up its work in reopening the underground workings of the *Suyoc* mine and erection of the mill. Recent diamond drilling has indicated high values of gold and copper ore. It is hoped that production will start in January of 1959. At the *Itogon* mill, operations are back to normal. A wildcat strike in June had caused some loss in production but this has now been restored.

INTERNATIONAL

NORTHERN TERRITORY—*Reynolds Pacific Mines Pty. Ltd.* is reported to have discovered a large bauxite deposit on Croker Island off Arnhem Land. The company has been prospecting along the Arnhem Land coast and on nearby islands for some time.

WESTERN AUSTRALIA—*Australian Blue Asbestos Ltd.* has placed a new £350,000 mill in operation, thereby enabling it to increase production from 12,222 tons in 1957 to 25,000 ton in 1959. The current year's output is about 18,000 tons. The company's reserves in the area are expected to last 100 years at present production rates. A contract with *Johns Manville Company* of the United States runs until 1961. Meanwhile, Japan appears to be becoming an important market for the product and encouraging orders have already been received.

NEW SOUTH WALES—*New England Antimony Mines N.L.* at Guyra is showing better returns each month. The company has been dogged by misfortunes since its inception three years ago, but is now supplying all of Australia's requirements of metallic antimony. Over 100 tons per month are now being produced from 600 tons of ore and the mine has ore for two years ahead. The mine's floatation concentrates are smelted in Sydney. Unfortunately, world market prices for antimony do not make it possible to increase output beyond what can be consumed in Australia; therefore, operations must continue to be small scale and costly.

REPUBLIC OF THE PHILIPPINES—With new machinery and equipment being supplied by Japan, *Gabun-Paracale Mining Company* plans to increase monthly output to 10,000 metric tons of iron ore. Until now, the operation had been on a "pick and shovel" basis, and the limited production had been sold locally. The firm now hopes to explore and develop more fully its 61 mining claims in the Paracale area of Camarines Norte.

SOUTH AUSTRALIA—Production of gypsum in 1957 increased for the third successive year to an estimated 270,000 tons. It was 263,136 in 1956 and 204,522 tons in 1955. South Australia produces more than half of the Commonwealth output of gypsum which in 1957 was 475,180 tons. The gypsum deposits are largely sediments of ancient seabeds, and semi-arid conditions are essential for their preservation. The mineral is found in areas with less than 20 inches of rainfall per year and South Australia comes largely within this category.



LATIN AMERICA

CUBA—North American Mining Corporation has been formed by *Bunker Hill Company*, *St. Joseph Lead Company*, *Falconbridge Nickel Company*, and *Blyth & Company* in order to bid on the government-owned nickel plant at Nicaro. Each of the three mining companies has a 30 percent interest in the new firm, while Blyth has a 10 percent interest. Harold E. Lee, Bunker Hill vice president, is president of the new firm.

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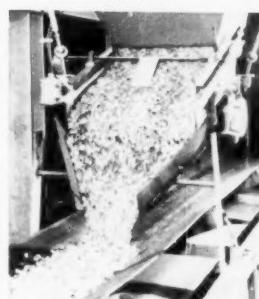
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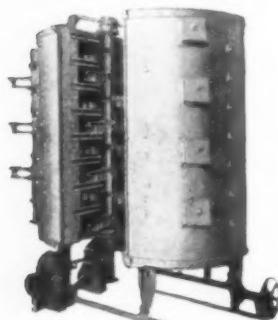


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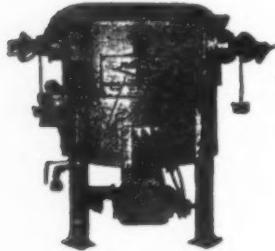
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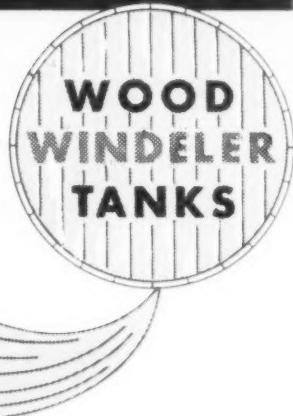
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INTERNATIONAL

MEXICO—*Cassiar Copperfields Ltd.*, with headquarters in Vancouver, British Columbia, Canada, has purchased six groups of claims in the state of Michoacan. The company has also acquired a 30-square-mile mineral concession located west of the purchased property from the Mexican government. Immediate exploration is planned. Cassiar is maintaining its precious and base metal properties in the Portland Canal district of British Columbia in good standing.

CUBA—*Compania Minera Yarayao*, S.A. of Havana has purchased the *Triumph Mining Company's* 300-ton mill at Triumph, Idaho. The mill and other equipment were sold through *Machinery Center Inc.* after Triumph was forced to close because of low lead-zinc prices. The Cuban firm will ship the mill to its manganese property.

LATIN AMERICA—Twenty-one foreign ministers representing Latin American interests met with Secretary of State Dulles in Washington, D.C. in September. From these conferences came the announcement that the United States will aid in establishing an inter-American bank to finance Latin American industries and to aid in stabilizing commodity prices through raw materials guarantees.

JAMAICA—*Kaiser Bauxite Company* has reduced production at its Kingston operations and laid off 120 workers. The cutback was due to decreased demand for aluminum in the United States, according to company officials.

COLOMBIA—*South American Gold & Platinum Company* reported a decline in earnings for the six-month period ended June 30, 1958, as compared to the corresponding 1957 period. Income for 1958 totaled \$3,515,257; \$7,927,238 in 1957. The decrease was attributed to a three-month drought which reduced hydroelectric power output at the wholly-owned subsidiary, *Frontino Gold Mines Ltd.*, properties and cut mine production to 50 percent of capacity. Current production is reportedly approaching full capacity. Other factors contributing to the loss were the drop in platinum prices and increased production costs in Colombia.

BOLIVIA—The *Bolivian Mining Corporation* reported losses amounting to 1,575,542,162 bolivianos in operating 14 nationalized mines during 1957. In 1956 the loss was 1,742,186,266 bolivianos. According to the report, exhaustion of deposits, insufficiency of electric power, lack of operating capital, lack of discipline, and maintenance of superfluous personnel were to be blamed for the loss. In addition, fall of world prices for lead, zinc, and copper increased the deficiency. Despite the losses, the economic situation was considered relatively satisfactory, provided all assets could be used.

VENEZUELA—Production of asbestos from *Anveco C.A.'s* property at Tinaquillo has increased from 1,500 tons to 15,000 tons per year, as the result of a modernization program recently completed. The deposit was discovered nearly 25 years ago and has been mined commercially for more than five years, but this is the first large-scale effort to use modern, high-speed milling methods. *Anveco C.A.* is an affiliate of *World Commerce Corporation S.A.*

COLOMBIA—*Asnazio Gold Dredging Ltd.'s* plans to terminate operations in Colombia have not yet been completed. Dredging operations were halted in November 1956 and the company planned

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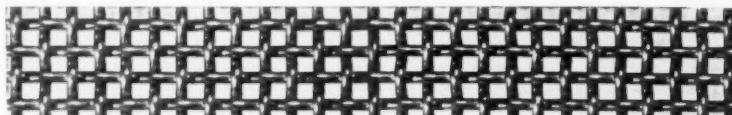
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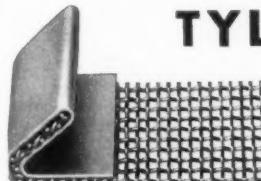
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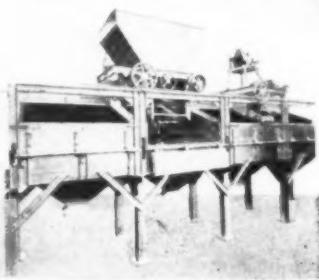
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INTERNATIONAL

to go into liquidation, with assets to be distributed to stockholders during 1957. Settlement of disputed land titles has prolonged the process, but withdrawal is expected to be finalized by the end of 1958.

BOLIVIA—According to recent reports from Bolivia, *Corporación Minera de Bolivia* will close the Kani mine because of present depressed tin prices. Earlier in the year mine production was cut back, eliminating tungsten output, because operations proved unprofitable.



NORTH AMERICA

BRITISH COLUMBIA—*Bunker Hill Company* of Kellogg, Idaho has been investigating the River Jordan lead-zinc prospect near Revelstoke, under an option granted by *American Standard Mines Ltd.* and *New York-Alaska Gold Dredging Corporation*. A survey has been made for an access road connection between the property and nearby roads, and a route has been outlined which would have no grades steeper than 10 percent even though the property is at a high elevation. This completes work for the 1958 season. Activities are to be resumed in the spring.

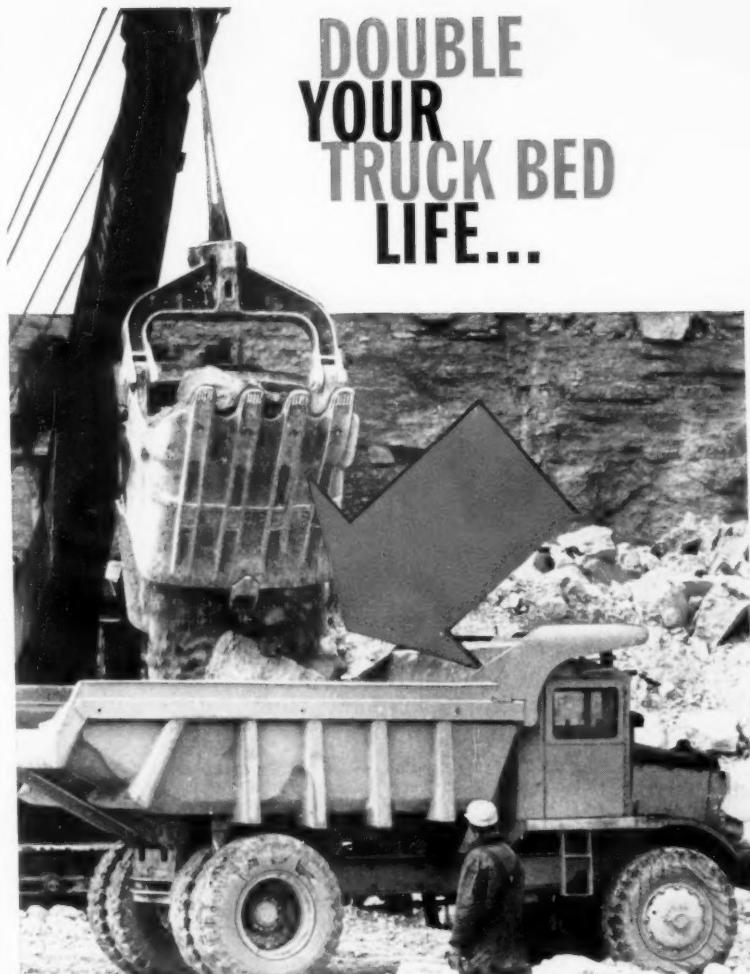
QUEBEC—*Noranda Mines Ltd.* is undertaking exploration of five groups of claims belonging to *Camp Bird Mining Ltd.* The 80 claims are in the Grasset Lake sector of the Mattagami area in northwestern Quebec. Camp Bird reportedly will have an interest in development of any discoveries made on the property.

ONTARIO—An initial program of exploratory diamond drilling is being undertaken on the nickel-copper property of *Polpond Mining Company*, some 20 miles northwest of Nakina, in the Lake Nipigon area. Dr. W. R. Newman, chief geologist of *International Mine Services Ltd.*, is directing the work. The Polpond property covers 979 claims selected by geophysical ground follow-up on anomalous indications obtained by an 800-square-mile survey flown over the area.

NORTHWEST TERRITORIES—*Salmita Consolidated* reported that its new gold discovery on the northwest shore of Horseshoe Lake has been further opened up by drilling and blasting. These operations revealed visible gold and considerable arsenopyrite mineralization.

BRITISH COLUMBIA—The 41st annual series of prospectors' training classes sponsored by the *British Columbia & Yukon Chamber of Mines* will open at the Point Grey High School in Vancouver on November 4. Lectures cover mineralogy, geology, mining and prospecting, and blow-pipe analysis. The series continues for three and one-half months. For further information, contact the Chamber of Mines at 751 Dunsmuir Street in Vancouver.

QUEBEC—*Quebec Cartier Mining Company* has announced awarding of contracts in connection with its Mount Wright iron ore project. The contract to build the 193-mile railroad from Port Cartier to Lac Jeannine has been awarded to a joint venture of *C. A. Pitts of Canada Ltd.* and *Foley Brothers of Canada Ltd.* The *Foundation Company of Canada Ltd.* received the general construc-



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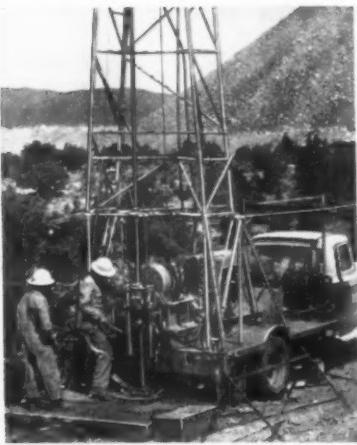


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INTERNATIONAL

tion contract for a 60,000-horsepower hydroelectric plant on the Hart-Jaune River. Total cost of the entire mine project is set at between \$200,000,000 and \$300,000,000.

SASKATCHEWAN—*Cayzor Athabasca Uranium Mines* has been steadily increasing its shipping rate and hopes to reach 150 tons by the end of the year. During August and September the rate was 50 tons per day, and increased to 100 in October. The ore goes to the *Lorado* customs treatment plant. Preparations are being made to test below the 570-foot level to a depth of 820 feet. If satisfactory, the mine may be opened at deeper levels.

QUEBEC—The *Phelps Dodge Corporation of Canada* has arranged with *Chibougamau Mining and Smelting Company* to explore an extensive group of claims in Scott township, about five miles east of Chapais. PD will underwrite the cost of the exploration; if results warrant continuation, PD will reimburse Chibougamau for expenditures previously made and will extend the agreement for a five-year period. Chibougamau will have a 20 percent interest in any new company formed to develop the property at a future date. Phelps Dodge has also entered the Mattagami area of Quebec. The firm has optioned a 50-claim group from *Chess Mining Corporation* about four miles to the northeast of *New Hosco's* big discovery. A five-man crew is already at work on the property. The option agreement covers a three-year period. If a new company is formed to develop the property, Chess would have a vendor interest.

Russian Iron Miners

Continued from page 39

Institute was Andrey Borisovich Patkovsky, vice director in charge of design. He is a mining engineer and specialist in the field of ore treatment and beneficiation plant design. Mr. Patkovsky's section employs 700 persons who design plants, assist in design and manufacture of new ore dressing equipment, and act as consultants during start up of new mills. A large beneficiation plant is now being designed under his supervision to treat ore assaying only 16 to 18 percent iron.

The Krivoi Rog iron mining district in the Ukraine has long been famous. From this district came Ivan Ivanovich Savitsky, director of Jugok (Southern Ore Enrichment Combine). He undoubtedly will play an important part in a new taconite plant planned for the district to treat 38 percent "quartzite" ore. By 1965, production of concentrate from this ore is scheduled to increase to 14,390,000 metric tons. It was only 370,000 in 1955.

Increased steel production means that more iron ore must be mined. Ivan Yakovlevich Grishchouk, director of the Southern State Mine Planning Institute, was the sixth member of the delegation.

THE END

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Abbott Mine

Continued from page 38

results were completely negative in any one stage, the contract could be terminated by mutual agreement short of the total expenditure estimated for the combined three stages.

Underground diamond drilling was to be done on the 115 level southeast of the Original Back dike ore body. Surface diamond drilling was to be done in an area further southeast to explore both the Back dike and the Front dike.

As a result of the exploration effort the Preston ore body was found along the Back dike. It was found some 400 feet southeast of the Original. To December 31, 1957, the Preston has been mined with an extraction of 20,588 tons of 9.07 pound mercury ore. Both mineralization and structure indicate possible improvement at depth. This led the company to development of the 200 level below the Preston. In June 1957 stoping on this level had just begun. The ore appears to go still deeper and the old Drain tunnel is being driven to get 50 feet of back under the 200 level of the Preston.

Still another ore body, the Turkey Run, was found and developed southeast of the Preston on the second amended DMEA contract. This means that two ore bodies can be worked which will provide added flexibility in maintaining an average grade of furnace feed. These discoveries prove that large stretches of the Back dike are mineralized, and indicate similar possibilities in the zone extending 1,000 feet to the southeast.

Future Outlook

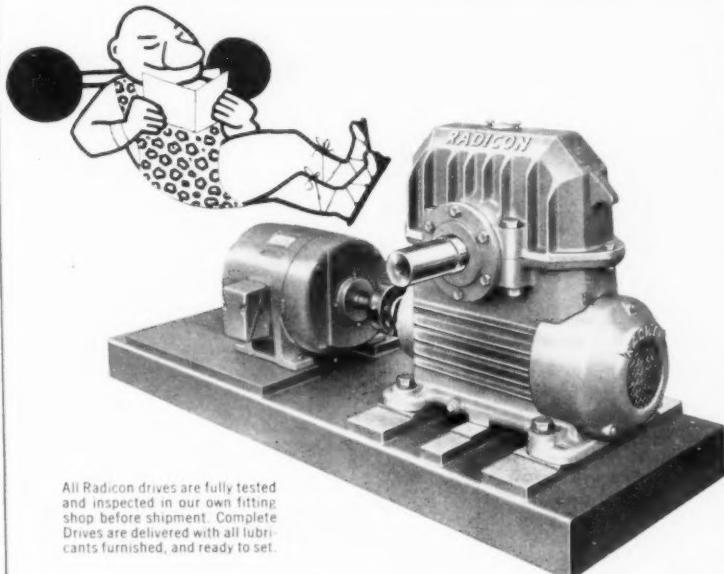
The Abbott mine, under the guidance of C. O. Reed, manager, and Fred Hanson, geologist, is now in the best condition in its 96-year history. Though the mercury deposits, like most others in California, are shallow-seated, they are found along a strike length of 6,600 feet. True, the ore bodies are dispersed horizontally by a series of transverse faults which cross the multiple dike system, but the fact that only a few of such favorable intersections have been explored is the principal asset of the property.

At the end of 1957, positive and probable ore reserves had increased to a 3-year supply at the current 70-ton-per-day rate of treatment. Possible or inferred ore has increased tremendously. It is entirely possible that the mine can produce another 50,000 flasks of mercury if market conditions are favorable.

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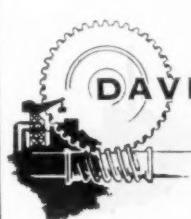
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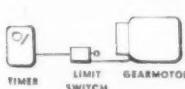
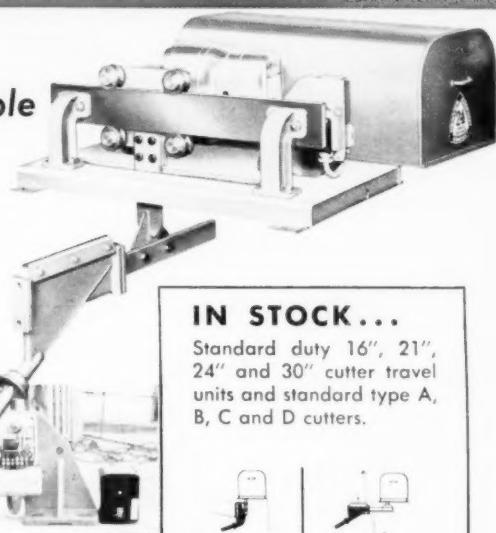
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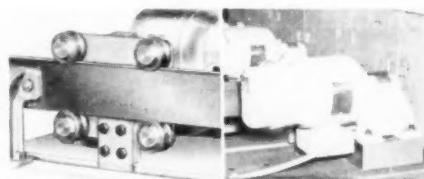
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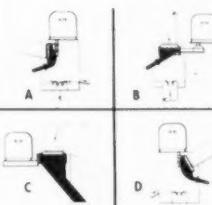
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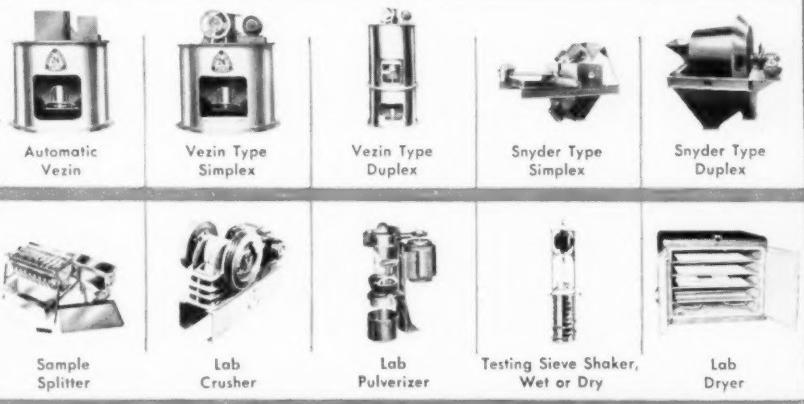
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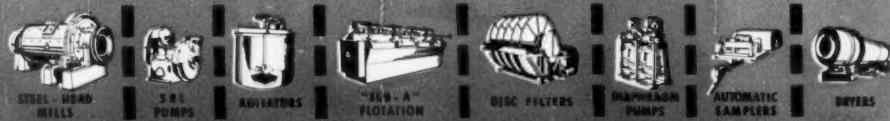
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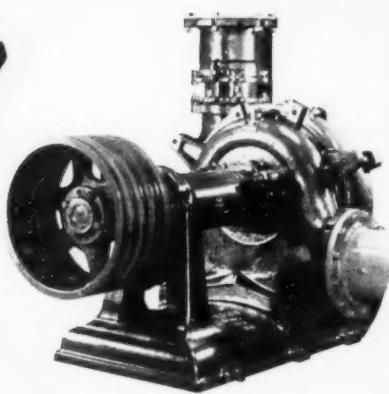
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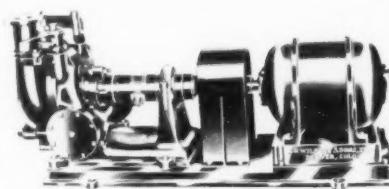
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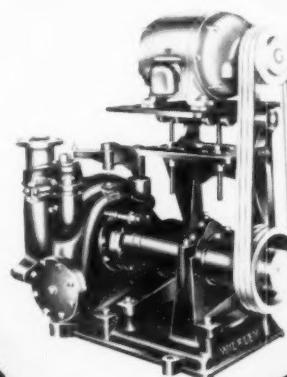
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